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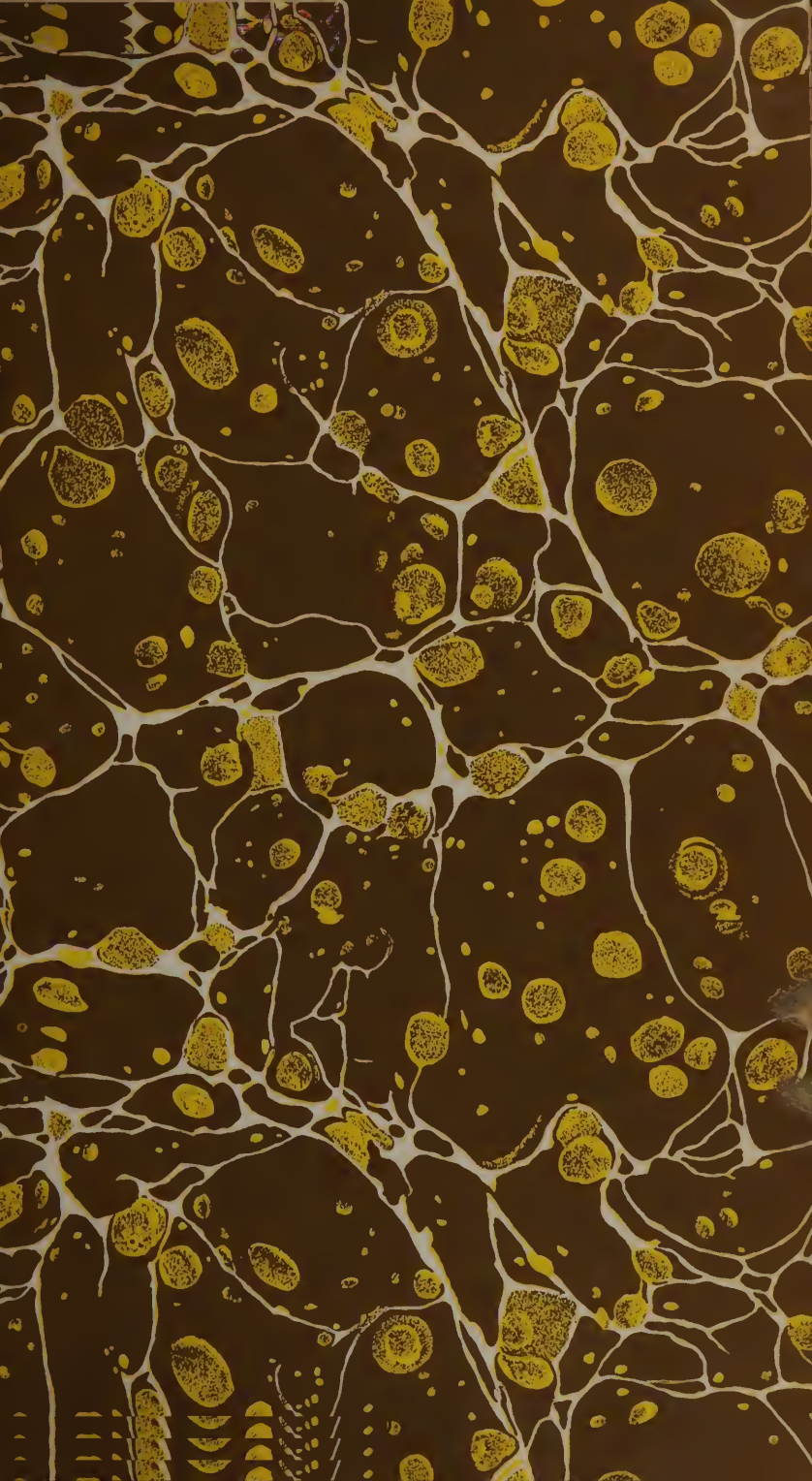
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A

*John R. W. Dunbar*  
*from the Author*

TREATISE  
OF  
PATHOLOGY  
AND  
THERAPEUTICS.

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IN THREE VOLUMES.

==  
VOL. I.  
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LEXINGTON, KENTUCKY

.....  
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## ADVERTISEMENT.

It is but just to state that notwithstanding this work is published in Lexington, the two first volumes (except the last forty or fifty pages) were printed in Winchester, Virginia, in the office of Mr. SAMUEL H. DAVIS, to whose great care and attention I am indebted for the handsome dress in which they appear.

J. E. C.

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## PREFACE.

THE investigation of the manner in which the remote causes of disease operate on the human system in producing the symptoms we observe, is one of the most important subjects that can engage our attention. This investigation has notwithstanding been so loosely conducted, that few principles are established, the explanations of the phenomena of fever by the most celebrated physicians have been so unsatisfactory, that at the present moment there is no received theory, and we every day hear doctrines directly opposed to one another, asserted with the utmost confidence of their being well founded.

In this conflict of opinion, how are we to ascertain the truth? What are we to believe? Let us profit by the experience of others. Less than two centuries ago, Natural Philosophy which now stands on a basis so firm, was as much embarrassed by contradictory doctrines as the science of Medicine now is. It emerged from this state by a method so simple, and so reasonable, that to hear it stated is all that is necessary to convince us of its propriety.

It consists in making experiments and observations, and in drawing general conclusions from them, and admitting no objections against the conclusions, but such as are taken from experiments or other certain truths. This is the method of philosophizing of the great Newton; and one of the rules by which he and his associates were governed in their investigations, is, that propositions drawn from the phenomena of nature "are to be deemed, NOTWITHSTANDING CONTRARY HYPOTHESES, either accurately or very nearly true, till other phenomena occur, by which they may be rendered more accurate, or liable to exceptions."

Before this time natural philosophers (to use the language of one of them) "disregarding experiments, the only sure foundation

whereon to build a rational philosophy, busied themselves in framing hypotheses for the solution of natural appearances;" "whereas the philosophers of later times, laying aside those false lights, as being of no other use than to misguide the understanding in its searches into nature, betook themselves to experiments and observations, and from thence collected the general powers and laws of nature." This portrait of Natural Philosophy as it was, bears too strong a resemblance to the science of Medicine as it now is. Long since convinced that experiments and observations are the only true foundation of knowledge, and that hypothesis is the ignis fatuus by which we are led astray, the author of the following pages has endeavoured, in the investigation of the changes produced in the system by the remote causes of disease, carefully to adhere to the abovementioned method of philosophizing. How far he has done so, must be left to others to decide: every departure from it will no doubt be observed, and it is his wish that it should be; for if he knows himself, he desires that the truth should prevail.

It is not intended to say that this method has never been followed in medical writings. Its adoption by natural philosophers, together with its manifest reasonableness and propriety, and the advantages that have grown out of it in relation to that branch of knowledge, have so influenced the minds of all literary men, that it has imperceptibly been more or less adopted in every department of science. But there is still much to be done in Medicine. There is still too much explanation founded on hypothesis, too much upon terms the precise meaning of which is not adhered to when they are used, and too much reference to unknown and undefined laws in explaining the operations of the human system.

It is sometimes urged that this method of philosophizing is only adapted to what are called the exact sciences, that in medical investigations we cannot attain to such certainty, and that we must therefore be content with probability.

It is replied, that although in prosecuting medical inquiries, the field of experiment is limited, that of observation is unbounded. If there be questions which we cannot decide because the truth on certain points is not ascertained, it is deceiving ourselves to



come to a conclusion without it, and rest on conjecture or assertion. It is the better way, the only rational way to defer our decision; if we do not know, to say we do not; and immediately to resort to experiment and observation in order to settle them. As long as we continue to draw our inferences, and build our doctrines on this foundation, we proceed with certainty. What is done is never to be done again: it is settled forever. But if through impatience of this slow way of investigating a subject, we fly to conjecture, a door is opened at once destructive of the very object, settling the question: for, as every man can conjecture, many conjectures are made, and contradictory doctrines are maintained, sometimes with a pertinacity only equalled by their absurdity.

Although the investigation into the manner in which the remote causes produce the symptoms of disease, is, as the late convenient and forcible method of illustrating the subject, conducted in the following pages by inquiring into the effects of those remote causes, next into the effects of those effects, and so on descending to the symptoms, it is proper to state that this was not the course the inquiry actually took.

The writer for many years had had his attention turned to this subject. Accustomed from the natural turn of his mind, as well as from the course of his education, to rest his belief on evidence alone, and to receive as true nothing not thus supported, he could not assent to theories built on round assertion, without the shadow of evidence to support them. He could not therefore but reject the theory of Cullen, a mere pile of conjecture; nor that of Brown, overlooking the most palpable objections; nor even that of Rush, destitute of evidence to support a principal feature, that of sudden increase of excitability at the moment in which the action of stimuli has produced debility, and consequently exhaustion of excitability. In using this language respecting the productions of men of great genius, the writer only expresses that want of confidence in them, which has prevented medical men from receiving any one of them as a satisfactory solution of the problem. In truth he can say that the time never was in which he received as true any of the theories abovementioned.

Not satisfied however to practice empirically, his mind was often turned to the consideration of the important questions involved in the subject, and the long and solitary rides he was frequently called on to take, afforded opportunities for undisturbed reflection.

The first question which pressed on his mind, related to the cause of the derangement of the functions of the liver in the autumnal diseases. The symptoms observed were very commonly, by the mass of people and by many physicians, attributed to superabundance of bile, and this as well as many other popular notions, was derived from high authority in former days. The obvious relief afforded by a free discharge of bile, gave considerable countenance to the opinion; but the unanswerable objection was, that very often there is no bile discharged either from the stomach or the bowels, by the most active medicines, and the symptoms are more severe than in those cases in which there is an abundance of that fluid—and that a free secretion of bile is a most desirable object. It was evident then that the morbid symptoms are produced not by bile, but by the retained material of which bile is formed, viz. the blood in the liver. This led to the doctrine of congestion in that viscus being the cause of the disorder observed, a doctrine advanced by many late writers.

It was very evident that this cause is capable of producing an increased secretion of bile, but the question arose, can it likewise produce a suppression of the secretion? From what occurs in the mamma after parturition there is reason to believe it can. In that gland a certain degree of congestion or accumulation of blood produces increased secretion; a higher degree, such as produces hardness, suppresses secretion entirely.

The next question was, how are the other parts, the stomach, the head, &c. affected? By sympathy, is the common answer; which, while it acknowledges an intimate connexion between these parts, conveys no precise idea of it, and contains no explanation of its nature.

Revolving in his mind the nature of this connexion, the thought struck him that congestion, or accumulation of blood cannot exist in the liver, without extending into the vena cava, and its

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great branches, the jugulars, the emulgent veins, and the internal and external iliac veins; nor without producing an accumulation in all the veins leading into the liver, viz. in the veins of all the chylopoietic viscera. It was at once apparent that the same accumulation must affect the brain, and the stomach and bowels; and derange the functions of the latter, at the same time that it deranges those of the liver. Further reflection led to the observation that the same accumulation affects the kidneys and the uterus also.

Considerable time was spent in tracing out the effects of this accumulation of blood in the vena cava and its branches, in the several parts in which they are situated.

It was found that this cause is capable of producing pain in the head, vertigo, stupor, &c.; enlargement of the liver and pain in that part, increased secretion of bile, with nausea, vomiting and purging; or suppressed secretion and constipation; and in the glands of the stomach, increased secretion with ravenous appetite, or suppressed secretion and consequent want of appetite; flatulence and acidity; together with derangement of other parts not necessary to particularize.

An accumulation of blood in the interior veins was thus found to be capable of producing the symptoms preceding and accompanying fever: it still remained to account for the increased action of the heart and arteries. Blood being the natural stimulus of the heart, it is evident that a sudden increase of the quantity poured into it, must produce increased action of that organ, if it be at the time capable of it. The sudden accumulation therefore which takes place in the cold stage of fever, produces the increased action that follows; while the abovementioned affections of the head, stomach, liver, &c. which precede fever, are the effects of gradual accumulation of that fluid in the vena cava, &c.

The next question was, what is the cause of this accumulation? It had been observed that weakened action of the heart is always present in the commencement of these autumnal diseases, and that it is produced by all the remote causes of fever; and it was evident that it must, whenever present, necessarily produce accumulation of blood in the vena cava, &c.; and therefore that this is the cause.

When the inquiry had reached this stage, the manuscript was copied for publication, in 1822. It was however subsequently determined to inquire into the nature of the remote causes, the manner in which they operate on the system, and into some doctrines connected with this subject, viz. the identity of the forms of autumnal disease, the contagious nature of the yellow fever, and the contagious nature and origin of the typhus fever, and the plague. This addition, viz. the inquiry into the nature of the remote causes, &c. constitutes the first volume. The doctrines advanced have been familiar to my friends since the spring of 1822—To them I owe an apology for the delay of the publication. They had some reason to expect it in 1822 or 1823. Want of experience in the difficulties of such an undertaking in the midst of constant occupation, is the only excuse that can be offered. The sole dependance of a large family, until very lately, was on my exertions in the practice. This absolutely required attention to every call in a country-practice extending in one direction about twenty miles.

The result of the exposure connected with unremitting attention to such a practice, was bad health, in consequence of which it became necessary to seek a town-practice—At this period, in the beginning of 1822, it was expected that leisure would be afforded for finishing the work for publication. Unexpected success in business however, and the prevalence of very severe autumnal epidemics, together with the addition proposed to the work, delayed the commencement of printing until the summer of 1826. The same causes rendered the progress in printing slow, it being found impossible to devote more time than sufficed to keep one hand at work. In the summer of 1827, the interruption produced by my election to the professorship of the Theory and Practice of Medicine in Transylvania University, caused a suspension of the work; and the occupations growing out of this new situation have rendered it impossible to complete it before the coming summer. The solicitations of many of the medical class have induced me to publish the two first volumes embracing Pathology and the treatment of Chronic Diseases, leaving the third volume containing the treatment of Febrile Diseases, to appear in the course of the ensuing summer.



# PATHOLOGY AND THERAPEUTICS.

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## CHAPTER I.

*Felix qui potuit rerum cognoscere causas.*

1. **MANKIND** have ever shown a strong inclination to discover the causes of natural phenomena; and from the remotest ages their ingenuity has been exercised in the investigation of them. This propensity is not confined to the intelligent and the enlightened; even the stupid and the ignorant have their desire to know, and often their theories to explain the secrets of nature.

2. The inquiry into the origin and nature of the various forms of disease which afflict the human race is especially interesting; seeing that the natural propensity is stimulated by the importance of the subject to our well-being, and to life itself. Physicians, who are continually called on to relieve the afflicted, and whose best endeavours in their behalf are often baffled, are especially interested in ascertaining the causes of the morbid appearances, and particularly the proximate

cause, “*quæ præsens morbum facit, sublata tollit, mutata mutat.*”\*

3. They have accordingly shown, from the earliest times of which we have any record, the deep interest they feel in this subject. By their unwearied attention, and by a multitude of observations, they had early made considerable discoveries respecting those causes which remotely influence the body in such a manner that disease is eventually produced;<sup>1</sup> they had marked the phenomena that occur, and had laid down, with very considerable precision, those which indicate a favourable or an unfavourable termination;<sup>2</sup> and they had acquired a knowledge of many articles, vegetable and mineral, of great efficacy in the treatment of diseases.

4. The intermediate causes, however, connecting links between the remote causes and the symptoms of disease, and particularly the proximate cause, escaped them entirely. Consisting in changes wrought in the body by the remote causes, they are not subject to observation; and the only course by which to acquire a knowledge of them, is that of rigid inference from known facts, and of argument built on those facts and inferences. Yielding, however, to the impatient desire, natural to man, at once to solve every difficulty, this slow but sure course was deserted; and medical writers had recourse to conjecture, and formed such hypotheses as they deemed consistent with known facts, and sufficient to explain the phenomena.

\* Which when present causes the disease, when taken away removes it, when changed changes it.

<sup>1</sup> Celsus de Medicina, Lib. 3, cap. 23. Cum quibus fugere oportet solem, balneum, ignem, etc.

<sup>2</sup> Ibid. Lib. 2, cap. 8.

5. Physicians in succeeding ages have too closely followed the example. Although they have multiplied their experiments and observations, and have in the course of ages accumulated an immense number of facts, and made many efforts to explain the phenomena of disease, it is thought little progress has been made; and a writer of some distinction says, "The real derangement in the system which produces the external appearances in fever, it must be owned, is not at all known."<sup>1</sup>

6. The theories of the moderns, like those of the ancients, are founded on hypothesis or conjecture, and therefore have uniformly failed to give general satisfaction, for any length of time, in an age in which the Newtonian method of philosophizing has enlightened the mind of the public. Hence has arisen in some a kind of despair of ever seeing any satisfactory explanation of the phenomena of disease, and in others a contempt of all theory.

Speaking of Senac's attempt to explain some of these phenomena, one writer<sup>2</sup> says, "The physician who undertakes to account for the periodical recurrence and termination of the paroxysms of an intermittent, may be truly said 'to attempt the bow of Ulysses.' The matter is as much an *arcanum naturæ* now, as it was in the days of the father of physic. Nor does it seem at all probable that the thick veil which has hitherto concealed it will be shortly removed."

Some medical writers seem even to consider it a

<sup>1</sup> Fordyce on Fever, Dissertation 1, p. 47.

<sup>2</sup> C. Caldwell, M. D. Professor of the Institutes of Medicine and Clinical Practice in the Transylvania University. Note to ch. 9, book 1, of his Translation of Senac on Fevers.

mark of mature judgment to think theory of little importance.<sup>1</sup> “*Hinc factum est, non prorsus sine rationis specie, ut multis, cum medicorum, tum aliorum hominum, persuasum sit, omnem theoriam medicam prorsus vanam et futilem esse, et non modo non prodesse, sed revera multum nocere, animum nempe a vera notitia, quæ sola, ut volunt, experientia discatur, ficta scientia, avocando.*”\*

7. The same beautiful writer continues: “*Verum enimvero non ideo concludere fas est nihil veri aut certi de theoria artis medicæ unquam repertum iri,*” &c.† It would indeed be in the highest degree unbecoming, not only to sit contented under the slurs that have, with no sparing hand, been cast upon the profession, but even to pass upon ourselves the sentence, that we are but enlightened empirics, that we never can attain to such knowledge of the operations of the human system, under the influence of the causes of disease, as will direct us advantageously in our endeavours to obviate their effects. This indeed will not be done. Impelled by the innate propensity above alluded to (1), men will theorize, and the question is not whether we shall have a theory, or not; but whether we shall have a right one, or a wrong one.

8. Wrong theory leads almost inevitably to practice

<sup>1</sup> Currie’s Medical Reports, Vol. 1, p. 165. 169.

\* Hence it has happened, not altogether without an appearance of reason, that many, as well physicians as other men, are persuaded, that all medical theory is altogether vain and futile; and is not only unprofitable, but indeed very injurious, in calling off the mind, by counterfeit science, from true knowledge, which can be acquired, as they think, from experience alone.—Gregorii Conspectus. Introd. p. 19.

† But truly it is not therefore just to conclude, that nothing true or certain concerning the theory of the medical art will ever be discovered. Ibid. p. 19.

either directly injurious, or indirectly so, by its inertness, whereby a mortal disease rages uncontrolled. The heating treatment of small pox is an instance of the former ; the treatment of a fever in Leyden by Sylvius de la Boe is an instance of the latter. Resting on his theory that the fever was caused by an acid, he administered chalk to cure it, and being an influential man in the profession, his practice was followed, and two-thirds of the population are said to have died under the treatment.

9. It has indeed been said to be a matter of small importance what our theory is, if our practice be right. If our practice be right while our theory is wrong, it is accidentally right. The remedy has been discovered, as many have been, by chance ; as the beneficial effect of cold water in fever by patients jumping into the sea from a ship ; or by some similar exposure. But if, in attempting to derive the same benefit from the affusion of cold water, we apply it without a correct theory of its action, we may kill our patients ; as Dr. Currie of Liverpool, when about to show the good effects of the practice to a Russian surgeon, was very near doing with a patient by immersing him in cold water during a chill ;<sup>1</sup> and as a follower of his in that practice actually did in many instances by the affusion of water at improper periods.<sup>2</sup>

10. If a wrong theory be so injurious, and there is too much reason to believe that it has slain multitudes (8. 9), theory is not a vain thing (6), and it is a matter of the utmost importance to discover the true one.

<sup>1</sup> Currie's Medical Reports, Vol. 1, ch. 7.

<sup>2</sup> Ibid. Vol. 2, p. 358.



That there is a true theory it were absurd to deny. The remote causes of disease, operating on the human system, produce uniform effects. This must be the consequence of their operating in an uniform manner, and of the system's acting, under their influence, uniformly according to certain laws by which it is governed. The exposition of this manner and of these laws, or a statement of the immediate effects of the remote causes on the system, and of the changes wrought in it in consequence of these effects, will show the whole connexion between the agents ascertained to be remote causes of disease, and their effects the symptoms ; and is the true theory.

11. In the following pages I shall attempt the investigation of this connexion ; or, *a statement of the immediate effects of the remote causes on the system, and of the changes wrought in it in consequence of these effects.* The course which, it is believed, the inquiry must necessarily take to be successful, is stated in a few observations which follow.

12. Every phenomenon is the effect of some cause producing it ; that cause was likewise produced by a second ; that by a third ; and so on, extending upwards in point of time of existence. This succession of cause and effect constitutes a chain of effects, or of causes, according as it is viewed in the descending or in the ascending line.

13. Each phenomenon is therefore, at the time of its appearance, the termination or last link of a chain of causes. That link of such a chain, which is nearest the phenomenon observed, which immediately produces it, is the proximate cause ; those links more remote

from the phenomenon, are called its remote causes. The proximate cause, as well as every other link of the chain below the remote cause, is therefore an effect of the remote cause.

14. Different effects may flow from one remote cause. In this case the chain of causes ascending from each effect, must terminate in that remote cause from which they all proceed. These chains of causes may not all continue distinct until they arrive at the remote cause, but may fall into one another, as they ascend, before they arrive at it. Thus a remote cause may produce a single effect, which may be the cause of another single effect, from which several effects may directly or indirectly proceed.

15. That link in which the ascending chains from several effects first coincide or unite, is the proximate cause of all those effects; for in the ascending line it is the nearest cause from which they all flow. Any cause more remote cannot be the proximate cause; any one nearer is the cause of only a part of the effects.

16. Different remote causes may produce the same effects; and we often find them co-operating to produce them.

In this case it is plain that the descending chains from the different remote causes coincide at some point as they proceed downwards, and co-operate in producing some link of the chain. That link must be one from which all the effects proceed; otherwise, the remote cause, which co-operates to produce it, would be the remote cause of only a part of the effects.

This may be the proximate cause (15), or it may be a link which produces the proximate cause. That is,

that link in which the descending chains first meet, may be the same with that in which the ascending first meet, or the proximate cause (15); or the former may be the cause of the latter.

17. The proximate cause is an effect of all the remote causes (13. 15. 16); and therefore all the causes which produce it, are remote causes of its effects.

18. Applying these manifest truths and inferences to the phenomena of disease, the remote causes of fever, and the whole train of symptoms proceeding from them, denominated a febrile paroxysm, with all the intermediate links, constitute a series of causes and effects; the chains of effects descending from all the remote causes uniting in each symptom, and the chains of causes ascending from all the symptoms uniting in each remote cause. Every effect of the remote causes is one point of the series, one link of the chain; is the effect of the causes preceding; is the cause of the effects succeeding.

19. Hence it is evident that, in order thoroughly to investigate *the connexion between the remote causes and the symptoms of disease* (11), we may inquire into the effects of the causes ascertained; next into the effects of those effects, or new causes; and so on, descending until we arrive at the ultimate effects, the symptoms in question: or, that we may inquire into the causes of the symptoms, and into the causes of those causes, and so on, ascending until we arrive at the remote causes; or, that these two modes may be combined, and that the agreement of the two in the same result is a strong confirmation of its truth.

20. Instead, however, of following this simple and

natural course, and bending their whole attention to the inquiry, in the descending line into the effect, or in the ascending line into the cause, of the successively ascertained points of the series of causes, and thus step by step dispelling the gloom in which the subject is involved; physicians have, as was before observed, resorted to hypothesis for aid to enable them to explain the phenomena observed in disease.

21. Before we proceed in this investigation (19), we shall endeavour to state the principal hypotheses which have been proposed, and to show their insufficiency. As most of the diseases which afflict mankind are accompanied by fever, this state of the system has attracted special attention; and great efforts have been made to explain its phenomena. Chronic affections have received comparatively little attention; and the opinions respecting them are vague and unsatisfactory.

22. The most ancient hypothesis we are acquainted with is that contained in the writings of Hippocrates; according to which health consists in the due proportion of the four humours of which the body was supposed to be formed; viz. phlegm, blood, bile, and black bile; and disease in an undue proportion of the same; the evil consequences of which were guarded against by the care of a superintending principle.

23. When an undue proportion of the humours exists, or when one is in excess, the superintending principle, according to this doctrine, excites a commotion, during which the blood is purified, the morbid humours discharged by the bowels, the bladder, or the skin, and, the purpose of the febrile commotion having been

effected, the inordinate action ceases, and health is restored.

24. This doctrine continued in high esteem in Europe until late in the 18th century; and was without a rival until the 16th, when the Chemical Sect of Physicians arose. According to their theory the fluids of the body are acid, or alkaline, and diseases are produced by the preponderance of one or other of those states; and are to be cured by the administration of medicines of the opposite character.

25. In the 17th century an attempt was made to apply mathematical and mechanical principles to the explanation of the phenomena of disease, and for a time attracted the attention of physicians. It was however soon found that neither the science which relates to the properties and dimensions of inert matter, nor that which concerns the mutual attractions of the elements of matter, is applicable to the explanation of the operations of the living body. These hypotheses were accordingly soon laid aside.

26. In the end of the 17th century the celebrated Stahl made an addition to the ancient doctrine. He believed that there is in the system a constant tendency to plethora; that this state and a bad state of the humours are the causes of disease; and that the office of the presiding power, to which he, like his predecessors, attributed intelligence, is to produce the necessary evacuations, as well as to correct the bad state of the fluids.

27. The leading points of this ancient doctrine, the humoural pathology, are, a bad state of the fluids, to which Stahl added a constant tendency to plethora;



and a superintending intelligent principle, whose office was to correct the disordered state, by exciting commotion, depuration, and evacuation.

28. It is defective in assuming, without proof, that the internal derangement consists in a disordered state of the fluids ; 2, in not showing how the disordered state or internal derangement is produced by the remote causes ; 3, in not showing how this state produces the symptoms of disease, particularly the increased action in fever ; 4, in referring them to a presiding power which is not shown to exist. In other words, it does not trace the connexion between the remote causes and the symptoms of disease (19).

29. Some few years after Stahl's addition to the ancient humoural pathology, Hoffman proposed a theory, containing a number of the doctrines of the day ; but in addition to them, he taught that health consists in a certain tone of the moving fibre, and disease in too great or too little tone ; in spasm or atony. "Ex hisce autem omnibus uberius hactenus excussis, per quam dilucide apparere arbitror quod solus *spasmus* et simplex *atonia*, æquabilem, liberum, ac proportionatum, sanguinis omnisque generis fluidorum motum, quibus excretionum successus et integritas functionum animi et corporis proxime nititur, turbando ac pervertendo, universam vitalem œconomiam subruant ac destruant ;" &c.\* It may be sufficient to

\* From all these considerations thus far copiously discussed, I think it clearly appears that *spasm* alone and simple *atony*, by disturbing and destroying the equable, free, and proportionate motion of the blood and of the fluids of every kind, on which the healthy condition of the excretions and the soundness of the functions of the mind and body immediately depend, overturn and destroy the whole vital œconomy.—Cullen's First Lines, Preface, p. xxiv.

object to this doctrine that spasm and atony are symptoms of disease ; effects of the remote causes ; and not themselves remote causes.

30. In the beginning of the 18th century, Boerhaave, a man of great genius, industry, and learning, intimately acquainted with all the systems from the time of Hippocrates, formed a theory of materials selected from every side, which was so well received, that his praises rung throughout Europe for a large portion of the 18th century.

He attributed diseases to various states of the solids and the fluids ; to a weak and lax, and to a stiff and elastic fibre ; to an acid acrimony, a spontaneous glue, and a spontaneous alkali in the fluids ; to excessive and to defective circulatory motion ; and to plethora. The diseases arising from each of these different states were to be cured by remedies tending to produce an opposite state of the system. It is needless to say a word respecting this system ; the absurdities to which it led may be seen in his Aphorisms.<sup>1</sup>

31. His theory of fever is, that some of the above and other remote causes produce the proximate cause.<sup>2</sup> He is not, however, precise in stating the proximate cause. He says, "Whence it appears, that then (in the cold fit) the bloody humours do stagnate at the ends of the capillary vessels, and that there is notwithstanding at the same time some cause that irritates the heart."<sup>3</sup> "So that the too quick contraction of the heart, with an increased resistance at the end of the capillary vessels, is sufficient to complete in us the idea of all acute fevers."<sup>4</sup> "So that after a due examen of

<sup>1</sup> Aphorisms 63. 64. 70, to 73. 85. 86.

<sup>2</sup> Ibid. 583. 586.

<sup>3</sup> Ibid. 577.

<sup>4</sup> Ibid. 581.

the whole history of intermitting fevers it must be concluded, that their proximate cause is a viscosity of the arterial liquid, upon which succeeds any one of the causes of the two strong and quick contraction of the heart, and a resolution of what had been stagnated.”<sup>1</sup>

He does not say whether the obstruction in the capillary vessels, which is assumed to exist, produces directly or indirectly the increased action, and he does not show that it does it in either way.

32. To these visionary doctrines, and to the monstrous absurdities connected with them, of which a full specimen may be seen in the works of Sydenham,<sup>2</sup> and in the Aphorisms of Boerhaave,<sup>3</sup> the language of Gregory is strikingly applicable: “Non est dissimulandum, theoriæ medicæ scriptores hominum patientia multum abusos esse, et sibi aliisque, nuper et olim, miris ineptiis impossuisse.\*

These theories have however been abandoned; and in their stead have been advanced several others, which have in turn attracted the attention, and divided the opinions of medical men.

33. Hitherto little notice had been taken of the remote causes of fever: Boerhaave mentions them, but does not show their operation on the system. Cullen, whose theory followed next, seems to have taken a more enlarged and comprehensive view of the subject than any of his predecessors. He pointed out the ef-

<sup>1</sup> Aphorism 755.

<sup>2</sup> Sec. 1, ch. i. art. 1. Sec. 1, ch. iv. art. 1. Sec. 1, ch. v. art. 2. 3 4. 10. Sec. 2, ch. ii. art. 11. Sec. 6, ch. iii. art. 5.

<sup>3</sup> Aphorisms 63. 64. 70, to 73. 85. 86.

\* It is not to be concealed that the writers of the theory of physic have greatly abused the patience of men, and have imposed on themselves and others, lately and formerly, by wonderful absurdities.—Gregorii Conspectus. Introd. p. 19.

fect of the remote causes, viz. debility, and after showing, from the symptoms preceding a febrile paroxysm,<sup>1</sup> and from the consideration that the remote causes are of a debilitating nature,<sup>2</sup> that a state of debility exists in the commencement of fever, he says,<sup>3</sup> "It is therefore evident that there are three states which always take place in fever; a state of debility, a state of cold, and a state of heat; and as these three states regularly and constantly succeed each other in the order we have mentioned them, it is presumed that they are in the series of cause and effect with respect to one another. This we hold a matter of fact, even although we should not be able to explain in what manner, or by what mechanical means these states severally produce each other." Instead however of patiently investigating the connexion he had observed between the different stages, whereby he might have discovered the manner in which the one produces the other, he contented himself with referring the matter to the old doctrine of a superintending power in the system,<sup>4</sup> which ever since the days of Hippocrates had been the resource of physicians in their attempts to explain the phenomena of fever.

34. Apparently desirous, however, of avoiding the absurdity of the doctrine of a superintending *intelligent* principle, he calls it a general law of the animal œconomy; but in the same paragraph,<sup>4</sup> speaks of it as *a power* producing effects, viz. "many of the motions excited in fever."

Considered in either light, referring to it those phenomena of fever, *which the author admits he cannot explain*, affords no information.

<sup>1</sup> First Lines, xxxv. <sup>2</sup> Ibid. xxxvi. <sup>3</sup> Ibid. xxxvii. <sup>4</sup> Ibid. xxxviii.

Referring certain morbid symptoms to a general law of the system, of the nature of which no account is given, nor any account of the manner of its operation in producing the effects, *is no explanation*.<sup>1</sup> It is perfectly obvious, a mere truism, that they happen by a general law of the animal œconomy. The question is, *What is that law? In what manner are these phenomena produced?*

Considered as a power there is no evidence of its existence.

35. This system is therefore defective in not explaining the manner in which one stage produces another.<sup>1</sup>

(2.) The inability to explain being admitted,<sup>1</sup> it is wrong in attributing the phenomena to *a power*,<sup>1</sup> the *vis medicatrix naturæ*, of the existence of which there is no evidence.

(3.) It is wrong in attributing to that power effects, of the existence of which there is no evidence, viz. spasm of the extreme vessels.<sup>2</sup> The evidence which Cullen offers, “the suppression of all excretions, and the shrinking of the external parts,”<sup>3</sup> may be imputed not only “in part,” but wholly “to the weaker action of the heart in propelling the blood into the extreme vessels.”<sup>3</sup> There is at any rate no certainty, and Cullen’s own language, “there seems to be a spasm,”<sup>3</sup> shows a consciousness of the uncertainty of its existence.

(4.) It is wrong in attributing the increased action to that effect of the supposed power, viz. to spasm of the extreme vessels,<sup>4</sup> as to an intermediate cause; with-

<sup>1</sup> First Lines, xxxviii.    <sup>2</sup> Ibid. xliii.    <sup>3</sup> Ibid. xl.    <sup>4</sup> Ibid. xli.



out producing any evidence that such spasm, supposing it to exist, is capable of exciting increased action ; the doctrine being left to rest on the common opinion of physicians.<sup>1</sup>

(5.) This theory is moreover defective in excluding stimulants from the list of remote causes. They are, undoubtedly, often remote causes of fever ; by exciting the action of the heart and arteries too high to last, they indirectly produce the debility which precedes fever.<sup>2</sup>

(6.) It is wrong in stating that the causes act on the nervous system primarily, and, thus diminishing the energy of the brain, produce debility.

The remote cause, miasmata, produces effects on the system, viz. darkness of complexion and blackness of the blood, long before there is any diminution of the energy of the brain. On the contrary, it is often observed that persons just before an attack of fever are extraordinarily brilliant in their thoughts and language.

The remote cause, cold, produces a manifest weakness of the action of the heart and arteries, long before the energy of the brain is lessened.

36. The theory of Cullen is superior to the ancient theory of Hippocrates, in attributing the phenomena observed to a law of the animal œconomy, instead of an intelligent superintending principle ; but of the mode of operation there is no more explanation in one than in the other : Cullen having referred to that law, as to a power producing the effects, without showing *how* they were produced ; and having offered no evi-

<sup>1</sup> First Lines, xxxix.    <sup>2</sup> Ibid. xxxvii. and Rush, Vol. 3. p. 3.

dence of the existence of the only specified means of producing, or intermediate cause of the increased action, viz. spasm of the extreme vessels.

That this state of these vessels exists, he does not show (35. 3); how it was produced, he admits he cannot explain;<sup>1</sup> how it produces the effect attributed to it, he does not attempt to say (35. 4). In short, he does not trace the connexion between the remote causes, and the symptoms of fever (18. 19).

37. Brown taught that the life of man and other animals consists "in this property alone; that they can be affected by external agents as well as by certain functions peculiar to themselves, in such a manner that the phenomena peculiar to their living state, that is their own functions, can be produced."<sup>2</sup> This property is called excitability; and the external agents, exciting powers.<sup>3</sup> The effect of the exciting powers acting upon the excitability, is to be denominated excitement.<sup>4</sup>

"Excitement, the effect of the exciting powers, the true cause of life, is, within certain boundaries, produced in a degree proportioned to the degree of stimulus. The degree of stimulus, when moderate, produces health; in a higher degree it gives occasion to diseases of excessive stimulus; in a lower degree, or ultimately low, it induces those which depend upon a deficiency of stimulus, or debility."<sup>5</sup>

"A is affected with a disease of debility, where the excitement has gone down to 10 degrees, the excitability mounted up to 70 degrees in the scale. What is

<sup>1</sup> Cullen's First Lines, xxxviii.

<sup>2</sup> Brown's Elements, x. <sup>3</sup> Ibid. xiv. <sup>4</sup> Ibid. xvi. <sup>5</sup> Ibid. xxiii.

to be done? By a proper use of high stimulants the 30 degrees of lost excitement may be restored, and as many of superfluous excitability discharged, and the excitement and excitability made to meet again at the middle point of 40. If the remedies are carried up to any degree betwixt 40 and 55, they have gone too far, and produced predisposition to sthenic diseases; if still farther, but not exceeding 70, they will have produced one or other of these diseases; but carried beyond 70, the diseases which their operation produces, are those of indirect debility."<sup>1</sup>

38. It follows from this doctrine that there is no other difference between sickness and health, than different degrees of excitement; 2, consequently, that a man drinking wine so as to produce the highest degrees of excitement, must have passed through one or other of the sthenic diseases; 3, that a man, in passing from a high state of excitement, in synocha for instance, to a low one, by letting blood, must pass through the state of health; and, as excitement is easily reduced by the loss of blood, that a man should be cured of a sthenic disease in a few minutes.

39. This doctrine also makes predisposition to sthenic diseases consist in increased excitement; whereas diminished excitement, sometimes in a remarkable degree, precedes even those diseases admitted by the author to be sthenic; viz. synocha, catarrh, &c.

It also considers disease as the direct effect of increasing or diminishing the exciting powers; diseases of excessive excitement proceeding from the former, and those of reduced excitement from the latter. In

<sup>1</sup> Brown's Elements, lxxi. note d.

opposition to this, however, diseases of the highest excitement often follow the abstraction of exciting power ; as in peripneumony, and dysentery from cold.

In short, this doctrine overlooks the whole train of causes between the remote causes and the symptoms of disease.

40. Rush's theory of fever is, that the effect of the remote causes of fever is to produce debility ; either by excess of stimulus first elevating the excitement of the system above its healthy grade, and afterwards reducing it down to that state which he calls debility of action ; or, by abstraction of natural stimuli, reducing the system below its healthy grade of excitement.<sup>1</sup>

(2.) Debility being thus formed in the system, a sudden accumulation of excitability takes place, whereby a predisposition is created to fever.<sup>2</sup>

(3.) Additional stimuli, or the common impressions which support life, sometimes become irritants, and readily add another link to the chain of causes which induce fever ; and that is, depression of the whole system, or what Dr. Brown calls indirect debility.<sup>3</sup>

(4.) By the continued action of stimuli, reaction is induced, and in this reaction, according to its greater or less force and extent, consist the different degrees of fever.<sup>4</sup>

41. According to this theory, in those cases in which stimulants are the remote causes,

(1.) Stimulants produce debility ; which is followed by accumulation of excitability.

(2.) Stimuli, additional or common, produce depression.

<sup>1</sup> Rush, Vol. 3, p. 3, 4.    <sup>2</sup> Ibid. p. 5.    <sup>3</sup> Ibid. p. 5.    <sup>4</sup> Ibid. p. 6.

(3.) Stimuli, morbid or natural, continuing to act, produce reaction.

(4.) Moreover, "the same remote cause is often debilitating, stimulating, and depressing;" or, to preserve the order in which the several stimuli are supposed to act (40), debilitating, depressing, and stimulating.

(5.) And further, "in certain fevers the remote cause sometimes excites convulsions in the blood vessels, (that is, fever,) without being preceded by preternatural debility and excitability; and with but little or no depression of the system."<sup>1</sup>

42. If this were the case, the increased action would be the direct effect of the remote cause, and the same as the excitement of Brown (37). But there are no such short cuts as this in natural operations. The succession of cause and effect is uniform. It is only because of the rapidity of the operation that, in some cases, we do not perceive the different steps; which nevertheless occur in order. All that are inconsistent with that rapidity, and occur not then, are not necessary, and therefore never do; as nature does nothing in vain.<sup>2</sup>

It is evident therefore that, having proposed as links of the chain of causes, states of the system, which he himself admits are not essential to the production of fever, he has overlooked the true series of causes extending from the remote causes to increased action of the heart and arteries.

43. Moreover, there is no real difference between the effect of stimulant remote causes, *debility of ac-*

<sup>1</sup> Rush's Works, Vol. 3, p. 14.

<sup>2</sup> Newton's first rule of philosophizing.



*tion*, and the effect of stimuli additional or common, *depression*, or the indirect debility of Dr. Brown (39); because, 1, both states are the effect of stimuli; and even the very same stimuli; as is broadly admitted by Rush (41. 4); 2, the marks of the second debility or depression, "weakness of the limbs, inability to stand or walk without pain, or a sense of fatigue, a dry, cool, or cold skin, chilliness, a shrinking of the hands and face, and a weak or quick pulse," are the well known effects of the remote causes, often produced in a few minutes; and even of the abstraction of stimulus, as on the application of cold. Therefore these states are the same, and depression, as a separate step in the process, does not exist.

44. It is objected also that stimulants, additional or common, having produced depression (40. 3), continuing to act, should continue to produce greater and greater depression, and never produce reaction.

45. This inconsistency is the more striking when it is stated that the same remote cause sometimes acts as debilitating, depressing, and stimulating; in other words, continuing to act on the same system, it first debilitates, next depresses, and lastly stimulates. It is manifest that a cause which debilitates will continue to debilitate, and that increased action will never take place without the intervention of some other cause.<sup>1</sup> This cause, connecting the remote causes and the symptoms of fever, is the desideratum of all the systems that have been offered to the world; and Rush, like his predecessors, has resorted to hypothesis as a substitute for it.

<sup>1</sup> Boerhaave's Aphorisms, 36.

46. His hypothesis, that debility, the effect of the remote causes, is followed by sudden accumulation of excitability, so great that the common stimuli which support life are enabled to produce all that follows (40), is unsupported by evidence, is destroyed by his own admission that it does not always occur (41. 5), and therefore is not essential; and appears to have been invented to account for the occurrence of fever or increased action when there are present no other stimuli than the common impressions which support life. For rightly believing stimulus necessary to produce action, and resorting to the common impressions which support life, when he perceived no other present; particularly when a chill and fever is produced by going into cold water; he found it necessary to invent a hypothesis to account for common stimuli producing increased action.

47. Darwin's theory rests on the same principle with the theory of Rush, that accumulation of excitability follows reduced action, and upon a sympathetic connexion supposed to exist between the different parts of the body.

"When any parts, which are naturally excited into perpetual action by stimulus, become torpid or less active from decrease of that stimulus; there first occurs a decrease of the activity of the parts next catenated with them."

"There next occurs an accumulation of the sensorial power of irritation in the parts which were torpid from defect of stimulus;" and "a similar accumulation of the sensorial power of association in the parts which were catenated with the former."

“ Whence if the subduction of stimulus has not been too great, so as to impair the health of the part, the activity of the irritative motions returns, even though the stimulus continue less than usual ; and those of the associate motions become considerably increased, because these latter are now excited by the previous fibrous motions, which now act as strong, or stronger than formerly, and have also acquired an accumulation of the sensorial power of association.”

“ But if the parts thus possessed of the accumulated sensorial powers of irritation and of association, be exposed again to their natural quantity of stimulus, a great excess of activity supervenes ;” &c.<sup>1</sup>

The whole theory rests on the doctrines of accumulation of sensorial power following torpor, and of associated motions, expressions equivalent to increase of excitability following debility, and sympathy, particularly on the latter, so much that the author denominated it the Sympathetic Theory of Fever.

48. These theories are defective in consisting too exclusively in attempts to account for the single symptom, increased action of the heart ; and in the resort, in order even to do this, to the hypotheses of a *vis medicatrix naturæ*, of sudden increase of excitability following the debility produced by the remote causes, and of a sympathetic influence between distant parts.

49. With respect to the sudden increase of excitability, the impossibility of its occurring in a degree sufficient to produce the effects observed, has been already shown (41. 42. 46).

50. With regard to the *vis medicatrix naturæ*, it is

<sup>1</sup> *Zoonomia* ; Theory of Fever. Sup. 1. 16. 2.

unquestionable that the body is so constituted, that an injurious impression often gives rise to an action or to a series of actions, the tendency of which is to remedy the evil. Thus, excessive exercise wastes the fluids by exciting perspiration, but gives rise to desire for liquids, by the gratification of which the system is replenished. But to represent this law of the system as a power, and to attribute to it important operations, without showing how they are effected by it, is not a very satisfactory mode of explaining difficult things.

51. The truth is, in this as well as in every other case of the application of agents to the body, those agents themselves, the phenomena observed on their application, and the intermediate links, effects of the former and causes of the latter, constitute a chain of cause and effect (12. 17); and the interposition of any power is unnecessary. The intelligence displayed does not consist in exciting an action to remove the evil then present; but in so constituting the system *originally*, that an evil impression made on it is the first link of a chain of causes, of which the last alleviates or removes the evil.

52. The doctrine of sympathy has no better foundation. Certain parts of the body, as the head, the liver, the stomach, are observed, in common, to be disordered together; so that when one is affected, the others seldom escape. To account for the simultaneous appearance of these affections, it is said that they are produced by sympathy between the parts in question. In order to understand the answer, and to judge of its correctness, it is necessary to ascertain the precise idea intended to be conveyed by this term.

53. In common acceptation, sympathy signifies fellow-feeling, or an affection felt by one person in consequence of the affection of another. When one is in distress, and we feel for him, we are said to sympathize with him ; but actual suffering of the person sympathizing is not included in the idea. If both are suffering, they are fellow-sufferers. Each suffers, but his suffering is his own.

Now in the case of different parts of the body suffering at the same time, it is obvious that their suffering is actual. Therefore they do not sympathize in the common acceptation of the word.

54. If the term be used in a sense different from that in which it is commonly received, it becomes necessary to define the sense in which it is used.

55. The advocates of this doctrine have defined sympathy to be such a connexion or consent between different parts, that "a certain condition prevailing in the one part occasions a similar condition in the other."<sup>1</sup> As however the affections of the parts sympathizing are often dissimilar, others have extended the signification of the term so as to embrace the latter also, and have given the name to such a connexion between distant parts, that when one is affected the other is likewise. A late writer has called it "the mutual influence of distant parts."<sup>2</sup>

56. Before we are at liberty, however, to attribute important operations to such influence of one part over another, it is absolutely necessary to show that it exists. What evidence of its existence is offered by the advocates of the doctrine ?

1 Cullen's First Lines &c. xliv. 2 Blane's Medical Logic, p. 143.



57. Whytt says, "besides this general consent which prevails throughout the whole body, there is a particular and very remarkable sympathy between several of its organs, (the organs of the body,) by means of which many operations are carried on in a sound state; and pain, convulsive motions, and other morbid symptoms, are often produced in such parts as have no near connexion with those that are immediately affected.

"To illustrate this I shall give several instances, beginning with the head, and taking the parts in their order downwards."

The following are a few of them.

58. "Violent pains in the head, which have their seat most commonly in the membranes of the brain or pericranium, are frequently attended with a sickness at the stomach, and vomiting."

"Light and noise are offensive both to the eyes and ears in severe headachs."

"The ear is frequently pained when the fauces are inflamed."

"A pain in the teeth often affects the cheek bone, one side of the head, the throat, and the corresponding ear."

"A disordered state of the stomach and intestines, with wind or noxious humours lodging in them, will sometimes so affect the brain as to deprive people of their reason. At other times the same causes will produce a vertigo, cephalæa, hemicrania, clonus hysterici, palpitations, intermissions of the pulse, difficulty of breathing, sudden flushings of heat, sweating, &c."

59. After giving many other instances in which he shows, as in those just mentioned, that certain parts of

1 Whytt on the Nerves and Nervous Diseases, p. 14 to 21.

the body being morbidly affected, certain other parts are also frequently affected at the same time, he says, "Many other examples of sympathy, both in a sound and morbid state of the body, might be mentioned ; but the above will be sufficient at present, as I shall have afterwards frequent occasion to touch on the same subject."<sup>1</sup>

60. Other writers treat the subject in the same way, and seem to think, when they produce cases of simultaneous affection of different parts, that they produce instances of the influence of one part over another. It is however very evident that they are no more than cases of the former, which the latter is introduced to explain : and it does not by any means follow necessarily, that this simultaneous affection is produced by a sympathetic influence of one part over another ; for it may be that these affections are the common effects of some cause operating simultaneously on the different parts affected. The question is, in which of these two ways do the affections occur together ?

61. The doctrine of a sympathetic influence of one part over another is beset with difficulties, and leads to absurd conclusions.

62. The introduction of this doctrine to explain the phenomena of fever, has led its advocates to fix upon the stomach as the seat of the primary action of the remote cause of fever, the most extensive in its operation. It has been asserted, that intermitting fever arises from a morbid impression made on the stomach, by the direct action of miasmata which enter by the mouth, the head and the liver being affected in conse-

<sup>1</sup> Whytt on the Nerves and Nervous Diseases, p. 29.

quence of the influence the stomach exerts over them. But to this doctrine there are insuperable objections.

63. The remote cause, miasmata, does not produce its first effects on the stomach. It affects the colour of the blood of every person exposed to its operation; and with this, the colour of the skin, and of the passages when under the operation of a cathartic, and often without. The blood, the skin, and the passages, all become darker; the former and the latter often black. This is the case with those who are apparently not at all affected, who are about their daily business and eating heartily.

Any body, during the prevalence of an autumnal epidemic of any severity, on taking a mercurial cathartic, and many without, will have black or green passages; or, if blood be drawn it will be found black.

64. The same remote cause often produces, before any disorder of the stomach is observed, other symptoms which precede fever and have therefore been called premonitory symptoms; as listlessness, weakness, sleepiness, slight pain in the head, vertiginous affections, &c. and all these in many cases in which the appetite continues good to the time of the attack. These symptoms preceding the affection of the stomach, it is very evident that the stomach is not the part first affected, and that they are not produced in consequence of an affection of that part, by means of its influence over other parts.

65. Moreover, many of the remote causes are of such a nature that the idea of their being taken into the stomach is absurd. A man exposed to a cold rain becomes chilly and a fever often follows: fear is apo-

ther remote cause of fever ; also loss of blood, a fall or a blow. None of these however act directly on the stomach. They nevertheless produce nausea, and some of them with more certainty than miasmata. Thus bleeding largely will certainly produce nausea and often vomiting : a fall or a blow often produces the same. The disorder of the stomach in fever therefore, is not the direct effect of the remote causes acting on the stomach.

66. Inasmuch as the stomach is very often not the part first disordered, and as this disorder when produced is not the effect of the direct action of the remote causes, it follows that the disorder of the head, liver, &c. is not the effect of a morbid impression on the stomach, by means of the sympathetic influence of the latter over the former.

67. A sympathetic influence of one part over another, implies a medium or channel of communication between those parts. There is no part known to have influence over another, without a channel to convey that influence. The influence of the brain is conveyed to the different parts of the body through the channel of the nerves ; and if the free passage of that influence through one of them be interrupted by ligature, vain is every effort to move the part supplied through that nerve. If this influence, so essential to the slightest motion of every part, to the well-being of the body, and to life itself, be not able to pass without a channel of communication, the strongest presumption arises of the necessity of such a channel in every case of influence of one part over another.

68. The advocates of the doctrine of sympathy, ful-

ly aware of this, have endeavoured to show that the nervous system is the medium.<sup>1</sup> If this were so,

(1.) When the brain is affected, all the other parts ought to be affected,<sup>2</sup> and the affection ought to be in proportion to that of the brain ;

(2.) Those parts which are intimately connected, ought always to suffer together ;

(3.) They ought to suffer in proportion to the closeness of the connexion.

69. But none of these inferences hold good :

(1.) The brain suffers in every way, when many parts escape ; and often those supposed to be most closely connected with it ; and the affection of those parts which are affected at the same time, is not in proportion to that of the brain ;

(2.) Those parts intimately connected, do not always suffer together ;

(3.) When they do, their suffering is not always in proportion to the closeness of the connexion.

The nervous system cannot therefore be the medium.

70. This is admitted by a late writer who strenuously advocates the doctrine of sympathy. He says, "We find in some old anatomical books, an attempt to trace sympathies to the ramifications proceeding from the common trunk of a nerve ; but better observation has proved that sympathies have little or no dependance on the connexion and distribution of nerves."<sup>3</sup>

<sup>1</sup> Cullen's First Lines &c. xliv. Whytt on the Nerves, p. 10.

<sup>2</sup> Whytt on the Nerves, p. 11.

<sup>3</sup> Blane's Medical Logic, p. 145.



Convinced, however, of the absolute necessity of a medium, he says, "the medium of this communication is *probably* some imponderable fluid ;"<sup>1</sup> an admission that there is no known medium.

71. A medium being therefore necessary, and none provided, for the passage of sympathetic influence from one part to another, none such passes, and therefore none exists ; the only purpose for which it is supposed to exist, not being effected.

72. There is evidently, therefore, nothing more than a simultaneous appearance of the affections in question (52. 60). Every thing more than this is assumed. Whytt's instances show no more. Cullen only presumes the existence of the consent.<sup>2</sup> Richerand asserts a relation between certain parts, but acknowledges we know nothing of its nature. No one argument is offered to prove the existence of sympathy.

73. Some have taken a more philosophical view of this subject, and have admitted that the term, sympathy, merely expresses the fact that there is a certain connexion between different parts, whereby when one is affected the other is likewise. According to this view, sympathy is the mere name of the connexion, and its nature is still a subject of investigation. Such however is the influence of names over the human mind, that we insensibly glide into the belief that we understand an operation when we have only given it a name.<sup>3</sup> Thus, if we ask why is the head affected when the stomach is disordered, and are told it is by sympa-

<sup>1</sup> Blane's Medical Logic, p. 143.

<sup>2</sup> Cullen's First Lines &c. xliv.

<sup>3</sup> Antiquum enim et usitatissimum apud medicos est, sibi aliisque persuadere se rem intelligere, cum nomen tantum didicerint, novam-

thy, there is an appearance of an answer; but it is evident we have learnt nothing; if we put the definition in place of the term. If we should answer the question by saying the head is affected by the connexion that exists between it and the stomach, no one would consider it a satisfactory solution.

74. There is a striking instance of this delusion in a work published by an eminent physician. After insisting on the retention of the term sympathy, on the ground that we must have some word to express what actually takes place in certain operations of the system, and if we reject this we must invent another, he says, "Some of the most striking phenomena, such as the translation and conversion of diseases; can in no other way be explained:"<sup>1</sup> Whence it is fair to infer that he thinks this word, expressing only what actually takes place in certain operations, *explains the nature of* those operations.

75. The following is an instance in which no infor-  
que rem se credere invenisse, cum novum tantum rei antea bene notæ nomen imposuerint. *Caveant autem medici, CAVEANT IMPRIMIS IN MEDICINÆ STUDIUM INCUMBENTES, ne hoc modo sibimet ipsis dent verba, UMBRAMQUE PRO SUBSTANTIA CAPTENT.* Gregor. Conspectus Medicinæ Theoret. Introd. p. 6.

For it is an ancient and very common thing among physicians, to persuade themselves and others, that they understand a thing, when they have only learned a name; and to believe that they have discovered a new thing, when they have only imposed a new name upon a thing well known before. *Physicians however should take care, AND ESPECIALLY THOSE WHO ARE EARNESTLY ENGAGED IN THE STUDY OF MEDICINE SHOULD BEWARE, lest in this way they deceive themselves, AND GRASP THE SHADOW INSTEAD OF THE SUBSTANCE.*

<sup>1</sup> Blane's Medical Logic, p. 143.

mation is conveyed by explanations founded on the doctrine of sympathy. The connexion of the surface of the body with the kidneys is called by the same writer one of "the most striking and important examples of sympathy."<sup>1</sup>

If we ask how is the secretion of the kidneys increased, when the perspiration is diminished; the answer is, by the sympathy between them; by the mutual influence of these distant parts on one another (55). What is there in this answer more than the assertion of a connexion by which the phenomenon occurs? of the nature of which we know nothing from the answer; while its very existence is only inferred from the fact which it is brought forward to explain. I need not say, this is not an explanation of the cause of the phenomenon.

76. With regard to the second branch of the question (60), are these affections produced by some cause acting simultaneously on the different parts; it is certain that these symptoms occur in consequence of exposure to the action of certain remote causes of disease; and therefore each of them is an effect of the operation of the remote cause, or of some intermediate cause on that particular part (18).

77. The relation between the affections of the different parts must therefore be that of cause and effect, or that of effects of a common cause. If one be the cause of the other, it must always precede; if it sometimes succeed the other, it cannot be the cause. If, therefore, in consequence of the action of certain causes, two affections ordinarily appear together, the one

<sup>1</sup> Blane's Medical Logic, p. 144.

or the other, indifferently, preceding, they are effects of a common cause.

78. In order to ascertain how and why these affections occur together, the proper course is to inquire the cause of each, and to trace up the chain of causes from each to the remote causes (19). Thus shall we discover the relation they bear to one another, or the nature of their connexion, and the reason of their occurring together.

79. We have thus endeavoured to show that the remote causes and the symptoms of disease are the extremes of a series of causes and effects; to point out the proper course of inquiry in investigating the connexion between them (19); to show that instead of prosecuting the inquiry in this way, physicians have had recourse to various hypotheses to enable them to explain the morbid phenomena; that these hypotheses are unfounded, at least to the extent assigned to them, and insufficient to explain the phenomena observed; and therefore that the great problem, what are the connecting links between the remote causes and the symptoms of disease, is not yet solved.

80. I shall now attempt the investigation of this connexion, by inquiring into the effects of the remote causes; next into the effects of these effects, or new causes; and so on descending to the ultimate effects, the symptoms in question (19).

## CHAPTER II.

OF THE REMOTE CAUSES OF DISEASE, THEIR MODE OF OPERATING, AND THEIR EFFECTS ON THE BODY.

81. The blood is the natural stimulus which excites the heart to action. "When we tie the two venæ cavæ so as to prevent the blood from arriving at the heart, the heart stops; when we slacken our ligatures and let in the blood, it moves again; when we tie the aorta, the left ventricle being full of blood will continue struggling, bending, turning up its apex, and contracting incessantly and strongly, and will continue this struggle long after the other parts have lost their powers."<sup>1</sup>

Thus, when the entrance of the blood into the heart is prevented, it ceases to act; when the blood is let into it again, it acts again; and when by tying the aorta, the blood is prevented from escaping from the heart, its continued presence produces continued action of that viscus. The blood is therefore the natural stimulus which excites the heart to action.

82. The action of the heart is measured by its effect, the distension, which we call the pulsation of the arteries. If this be forcible, we judge that the heart acts strongly; if it be weak, we judge the action of the heart is weak.

<sup>1</sup> Bell's Anatomy, Vol. 1, p. 342.



83. The blood, sent to the remote parts of the system by the action of the heart, communicates colour and warmth to the surface and extremities. If the action be increased by exercise, or in fever, the countenance is flushed; if it be diminished, or suspended, as in fainting, paleness and coldness ensue. The action of the heart therefore is also measured by the colour and temperature of the surface and extremities.

84. Experience has ascertained that certain external agents, some great bodily exertions, and some impressions on the mind, although they do not immediately produce disease, yet effect such an alteration in the state of the system, that morbid symptoms sooner or later appear. These are called remote causes of disease in contradistinction to the immediate or proximate cause.

85. All the remote causes of disease, directly or indirectly, weaken the action of the heart. We shall adduce evidence of the truth of this, with respect to each remote cause as it is mentioned.

86. If a person be deprived of food for several hours longer than usual, various morbid symptoms appear, with febrile action. This I have personally experienced many times. Dr. Currie, of Liverpool, relates the case of a gentleman who could not pass food into the stomach in consequence of a stricture of the lower part of the œsophagus. He died in four days after ceasing entirely from taking nourishment in any way. "The state of the pulse, as well as almost all the other symptoms, very nearly resembled the symptoms of the last stage of fever, when it terminates fatally."<sup>1</sup> Mo-

<sup>1</sup> Currie's Medical Reports, p. 211.

therby, and after him Parr, says, "when animals die for want of food, their death is not directly the consequence of hunger, but of a putrid fever."

87. These effects are sometimes produced on great numbers. There have been many instances of famine producing the death of thousands, with the symptoms usually appearing when other remote causes of disease operate extensively. It has accordingly been universally admitted to be a remote cause of disease in countries or cities, in which a dense population, in consequence of unfruitful seasons, or the devastations of war, have been deprived of subsistence.

88. If we abstain from food for several hours longer than usual, the action of the heart soon begins to decrease; and if the experiment be continued a whole day the pulse becomes very feeble, and the countenance pale, with a general feeling of excessive languor, evincing weakened action of the heart (82. 83).

89. Excessive bodily exertion producing fatigue, is another remote cause of various morbid symptoms. This I have often experienced, and often observed in others. Those who on a sudden emergency exert themselves excessively, are very apt to be indisposed and feverish for some days afterwards, and in the autumnal season the fever is frequently very severe.

90. Violent exertion of the body continued for a length of time, sends on the blood with such rapidity to the heart as to excite it to too great action (81), which soon unavoidably terminates in diminished action of that viscus, indicated, particularly when the exertion is very excessive, by a fluttering and feeble pulse (82. 83).

91. External violence from a blow or a fall produces fever, and various morbid symptoms, besides the local symptoms proceeding from contusion. Blows have the effect of reducing the action of the heart in a remarkable manner. A violent stroke, not on the head only, but on any part of the *body*, will in an instant stop the action of the heart. Falls have the same effect precisely, it being immaterial whether a body be impelled against a man, or he against the body. I have seen a person who had fallen from a horse continue for some time with a feeble pulse, pale countenance, and yawning and stretching, as in the cold stage of fever.

92. The depressing passions, fear, grief, &c. have long been observed to produce various morbid affections and to favour the attack of fever, rapidly promoting the spread of epidemics: they are therefore remote causes of disease.

These passions weaken the action of the heart. High degrees of them suspend and even extinguish it. Lower degrees produce feeble pulse and paleness of the countenance, indicative of weakened action of the heart (82. 83).

93. Want of rest or sleep is a remote cause of disease. The body when fatigued requires a certain time of inaction in order to recover its wonted vigour. If too little time be allowed for sleep, it becomes languid, and the weakness of the pulse and paleness of the countenance indicate weakness of the action of the heart.

94. Several of these causes are frequently conjoined in their action. The depressing passions, want of

rest, and great fatigue, operate together upon many of those who are attending upon sick friends. In these circumstances it has often been observed that the confident, the fearless, the cheerful, and those who attend the sick from a sense of duty, escape, while the timid fall victims to the disease.

95. Stimulants of every kind used to excess are remote causes of fever. Fermented liquors used too freely are followed by a feverish state on the following day. This effect is observed at any time, and in any circumstances ; but if other remote causes be in operation, their joint action produces a greater effect. Thus during the prevalence of an epidemic, many escape until they indulge in the use of wine, &c. to excess, when they are very liable to be immediately seized.

96. These stimulant drinks have a powerful effect in weakening the action of the heart. They stimulate it to increased, which necessarily terminates in diminished action ; and this, evident even after the first act of intemperance, shows itself much more clearly after repeated indulgencies, by the general languor, the paleness of the countenance, and the feebleness of the pulse (82. 83).

97. Strong tea produces considerable disorder and feverishness in many persons on the day following the use of it. In those who do not discover this effect immediately, it may be observed after a few days continuing to drink tea more frequently in the day, and stronger than common. Strong coffee has a similar, but not so great an effect as tea. Strong tea remarkably excites the action of the heart of most people, and

the continued use of it rarely fails to produce weak quick pulse, and pale complexion (82. 83).

98. Intense application of mind is so generally associated with other remote causes of fever, as want of rest, and sometimes with the use of stimulants, as strong tea, coffee, tobacco, opium, wine, or brandy, that some doubt might arise as to its efficacy in producing disease. Those however who have carried their application to great lengths for years, and who have abstained from the use of stimuli, have found, or may have observed, that they are incapable of devoting all of even the ordinary waking hours, for a length of time, without producing considerable disorder of the system, with feverish heat. It is therefore of itself a remote cause of disease.

Intense application produces in a striking degree the languor, paleness, and feebleness of pulse, which indicate weak action of the heart (82. 83).

99. Cold reduces the force of the pulse in a very short time, and paleness, coldness, and shrinking of the surface and extremities ensue, indicating weakened action of the heart (82. 83).

100. These are said by some to be only the first effects of cold; and it is alleged that it soon after raises the pulse and the temperature of the body.

101. If indeed a considerable degree of cold be applied to a healthy person, and in a few moments after be withdrawn, he will experience the last mentioned effects; but if the application of cold be continued, the pulse and the temperature will never rise as high as they were before the application.

102. The experiments of Dr. Currie, of Liverpool,



show in the clearest manner, that the continued action of cold reduces the pulse, and the temperature of the body.

103. With regard to the pulse, he says, it invariably sunk from 85 and upwards in a minute, to 65 or 68; became firm, regular, and small; but after being long in the bath, could hardly be felt at the wrist.<sup>1</sup>

104. With regard to the temperature; when a man is immersed in very cold sea water, the heat of his body is, in a minute or two, considerably reduced. If he continue in the water, his temperature after some fluctuations, during which it never rises to the height at which it was before immersion, rapidly decreases.

105. Currie states that a healthy man, twenty-eight years of age, with black hair and ruddy complexion, was immersed on four different days in sea water, at the temperature of 44 and 42 degrees. His temperature fell 9 degrees in two minutes, on an average of the four experiments. After the first fall there was some rise, but not to the same temperature as before immersion by near 4 degrees on an average.<sup>2</sup>

106. This small rise is however only temporary; immersion in cold salt water, continued for some time, producing a rapid fall. Thus in the seventh experiment the heat sunk at first 11 degrees, and then mounted in the usual irregular way, and at the end of thirteen minutes had ascended to 92 degrees, within two degrees of its height before immersion. Here it stood for nineteen minutes, with little variation; at the end of that time it began to fall rapidly, though irregularly, and in three minutes was as low as 85 de-

<sup>1</sup> Currie's Medical Reports, p. 152.

<sup>2</sup> Ibid. p. 145 to 148.

grees ; and it was not thought safe to push the experiment farther. In this experiment, when the heat sunk rapidly, Dr. Currie examined the motion of the heart, and found it feeble and languid.<sup>1</sup>

The same person who was the subject of the four first experiments, lost his heat in cold fresh water more gradually ; but throughout the experiment it continued to sink in a remarkably uniform manner.<sup>2</sup>

107. Now if this person, after having been immersed for half a minute or less, had jumped out of the water, there would have been an increase of the pulse and of the temperature. The conclusion is, that the effect of cold is to depress the pulse and temperature ; and the rise of both is plainly the consequence of withdrawing the depressing power. This happens in the following manner.

108. The action of the heart being reduced, less blood is propelled into the arteries, and consequently it accumulates in the vena cava. On removing the cause of the depression, the cold water ; the natural stimulus of the heart, the blood (81), being present in abundance, increased action immediately follows. Whereas when the cause of the diminished action is continued, the effect continues until the action of the heart almost ceases ; and it becomes evident that by a little longer exposure it would cease altogether.<sup>3</sup>

109. The same occurs when cold water is dashed on a person. A boy eight years of age, strong and sturdy, had three basins of cold water poured on his head and shoulders. He felt a glow of heat after it. This occurred every morning for some days ; but on

<sup>1</sup> Currie's Rep. p. 152.

<sup>2</sup> Ibid. p. 157.

<sup>3</sup> Ibid. p. 152. 158.

trying six basins, his temperature did not rise, but he became pale and even livid, and complained for some time of being cold.

110. Some experiments made by other medical gentlemen vary a little from those of Dr. Currie.<sup>1</sup> In these “the strength of the arterial action was in all cases diminished by immersion in cold water; but its frequency was, with scarcely any exception, increased; in many cases, from the combination of extreme weakness and rapidity, it was scarcely possible to count the number of the pulsations.” This variation, far from weakening, gives force to the conclusion drawn from the experiments of Dr. Currie; the last described pulse being one of extreme debility.

111. Cold applications to a small part of the body produce the same effect of weakening the pulse, and of course the action of the heart, in a minor degree. I know a lady, who, going into the kitchen to hurry dinner for some company, set to washing a cabbage in cold water, in which her hands and arms were immersed a short time: this exposure produced a chill in which of course the pulse was weakened, and therefore the action of the heart.

The following experiment was made on an uncommonly strong stout boy of twelve years of age. He sat with his feet and ankles in water at the temperature of 56 degrees, into which lumps of ice were put at the same time with his feet; the ice was not all melted at the close of the experiment. His pulse before immersing his feet beat 90 times in a minute, and mode-

<sup>1</sup> Dr. Stork, of Bristol, England, and Doctors Spooner and McDonnel, Edinburgh. See Rees's Cycloped. art. cold, 9th column.

rately strong. In the third minute there were 96 pulsations; 96 also in the fifth; 87 in the tenth; 82 in the fifteenth; 78 in the twentieth. The pulse all this time, and for two or three minutes longer, was softer and weaker; towards the latter part requiring considerably more attention than at first in order to feel it. There was some fluctuation in the strength, but every little increase was followed by a decline, and on the whole there was a decided reduction in strength. There were 80 pulsations in the twenty-fifth minute, and they had become fuller and stronger; 83 in the thirtieth; 85 in the thirty-fifth, and decidedly weaker than ever; 84 in the fortieth; 81 in the forty-fifth; 84 in the forty-eighth; 88 in the fiftieth, increasing in strength again; 80 in the fifty-fifth, declining again.

His feet were then taken out and the pulse became slower, and very strong and full, every pulsation as if with an effort; from the fifty-fifth to the sixty-fifth, 74 to 76 pulsations in a minute; in the ninety-fifth minute the pulsations were 75, and still full, flowing, and strong. The temperature was the same throughout.

112. The mode of the application of cold to the body makes no difference in the nature of its effects; exposure to cold air producing the same as that to cold water. The former, like the latter, reduces the pulse and the temperature of the body if continued; if withdrawn after a short exposure, the pulse and temperature rise. Cold air has very ready access to the neighbourhood of the heart by the lungs; in consequence of which people who are warm clothed, and exposed to a very cold air, are often severely affected before they are aware of it; the lungs not being sensi-

ble to any ordinary degree of cold. John Bell says, the heart feels, when it can be called nothing more than a *punctum saliens*, the slightest change of heat or cold.<sup>1</sup>

113. Cold applications internally to the stomach produce the same effects. Thus if a person drink cold water when heated, the force of the pulse will immediately be reduced, and the whole body cooled. If the draught be free, and the person in good health, he will soon after feel a glow on the surface similar to that produced by dashing a basin of cold water over the body. If he continue to drink glass after glass, the pulse will be reduced, as by the continued application to the surface. In persons of less vigorous health the application to the surface is not followed by a glow, and even one basin of cold water is apt to produce chilliness. Such persons often object to drinking cold water when recommended to them, alleging that it makes them chilly, and prefer for that reason putting a toast in it.

114. When cold applications are made to the scrotum, that part contracts; this has been advanced as a fact indisputably proving that cold stimulates.

This conclusion is founded on the assumption that contraction is a state of excitement, and it is argued, as excitement is the effect of stimulants, that cold is a stimulant. The foundation however is not sound. When the pulse is rendered feeble by continuing long in cold water, and the countenance is pale and even livid, and the body shaking with cold, the scrotum is rigidly contracted. This contraction is therefore no

<sup>1</sup> Bell's Anatomy, Vol. 1, p. 339.



more excitement, or the effect of a stimulant, than the contraction of the rest of the skin, at the same time, or in the cold stage of fever. The foundation failing, the argument falls, and cold is not a stimulant.

To those who may notwithstanding believe that contraction of the scrotum is a state of excitement; it may be suggested that, admitting it to be so, an effect may be produced by an agent directly or indirectly: the agent may be the immediate cause; or it may be the cause of some change, which is in turn the cause of the phenomenon observed. It is only by observation that we ascertain in which of these ways any effect is produced.

When therefore we see the scrotum contract on the application of cold, we are to inquire whether cold produces this effect directly, or indirectly by means of some change it produces. In inquiring into this point we must bear in mind that the direct effect of cold, in every way in which it is applied, is to diminish action (102, &c.); 2, that cold increases action only indirectly (107). We should therefore be well supported were we to determine that the contraction of the scrotum, admitting it to be a state of excitement, is the indirect effect of the application of cold. The force of this argument will appear in a stronger light by contrasting the effect of heat with that of cold on the same part. Heat produces exactly the opposite effect of relaxing the scrotum. With the same propriety that it has been argued that cold is a stimulus, because it produces contraction of that part, we may conclude that heat is not, because it relaxes it. We know, however, that heat is a stimulant, and there-

fore we conclude, that, if what is called relaxation of the scrotum be a state of deficient excitement, it is an indirect effect of heat. So we know that cold reduces action ; and when we see this debilitating power produce contraction, admitting this to be a state of excitement, we should conclude of course that it is indirectly produced.

115. In certain circumstances, chiefly of great heat and fatigue, a draught of cold water produces sudden death. Our harvest people in the midst of their labours sometimes die in a few minutes after a draught of water from a spring. The external application of very cold water in similar circumstances produces the same effect. Dr. Franklin says, " I once knew an instance of four young men, who, having worked at harvest in the heat of the day, plunged into a spring of cold water ; two died on the spot, a third the next morning, and the fourth recovered with great difficulty. A copious draught of cold water in the same circumstances is often attended with the same effect in North America."<sup>1</sup>

116. As many escape these effects who drink cold water and bathe in it, there is evidently something peculiar in the state of the persons injured by it. There are two opinions respecting the circumstances in which cold applications are fatal.

117. Dr. Currie contended that the danger arises from cold applications while the body is cooling after having been heated.<sup>2</sup> He says, " In all the cases which I have consulted, as well as in those I have related, three circumstances are either expressed, or may be

<sup>1</sup> Currie's Rep. p. 96.      <sup>2</sup> Ibid. p. 81. 94.

clearly inferred: 1, the body had been previously heated beyond the temperature of health by exercise carried to fatigue; 2, to this violent exertion a state of rest had succeeded; 3, a profuse perspiration had taken place."<sup>1</sup>

118. The cases stated are surprisingly opposed to the doctrine advanced. The first circumstance mentioned as occurring in these cases is correct; the second is in every instance the reverse, excepting perhaps one.

In the first case stated,<sup>2</sup> a young man having been engaged for a long time in a most severe match at fives, after it was over sat down on the ground panting for breath and covered with profuse perspiration. He called for a pitcher of cold water just drawn from a pump in sight, held it in his hands for some minutes, but put it to his head as soon as he had recovered his breath, and drank a large quantity at once. He laid his hand on his stomach and bent forwards; his countenance became pale, his breath laborious, and in a few minutes he expired.

In the second, after violent exertion at playing ball, neither the sweating nor fatigue having abated, the young man went into a cold wine cellar, drank, and died immediately.

In the fourth, fifth, sixth, and eighth, it is manifest that the sufferers drank greedily immediately on reaching the water without waiting for "a state of rest to succeed."

The seventh is of a mixed nature, but bears the same import.<sup>3</sup>

<sup>1</sup> Currie's Reports, p. 83.      <sup>2</sup> Ibid. p. 81.      <sup>3</sup> Ibid. p. 83.

119. Currie also quotes several instances in which great numbers suffered in the same way. He mentions one from Appian, in which the soldiers of an army, fatigued in battle and being very hot, drank greedily of the water of a fountain, and many died.<sup>1</sup>

He quotes another related by Gulielmus Tyrius : an army passing through a parched country at length arrived at a river, drank greedily, and many died.<sup>2</sup>

120. In the case of Alexander's army on the march through the desert of scorching sand, the very same thing occurred. Arrived, fainting under their toils, at the river Oxus, they immediately kneeled down and drank so intemperately, that Alexander lost more men here than in any battle he fought.<sup>1</sup>

121. In the case of Alexander himself, the same is most evident. He made a forced march through the defiles of Mount Taurus to save the city of Tarsus from being burnt by the Persians. "It was at the close of this extraordinary march, according to the testimony of all the historians, that the conqueror, advancing into Tarsus at the head of his troops, covered with dust and sweat, and exhausted with long continued toil, stripped himself in the sight of his army, and plunged into the pure and cold waters of the Cydnus which runs through the city. The symptoms that followed are described with sufficient minuteness and precision. *Vixque ingressi subito horrore artus rigere cœperunt : pallor deinde suffusus est, et totum propemodum corpus vitalis calor reliquit. Exspiranti similem ministri manu excipiunt, nec satis compotem mentis in tabernaculum deferunt. Q. Curtii,*

<sup>1</sup> Currie's Medical Reports, p. 84.

<sup>2</sup> Ibid. p. 85.

Lib. iii. cap. v.”\* Even in this case of the application of cold water to a person, immediately on his arrival at a river from a long and rapid march, “covered with dust and sweat,” and of course without interval, without time for rest, Dr. Currie makes the extraordinary supposition that he “must have been cooled, as well as debilitated, by excessive perspiration and fatigue.”

122. The only case which affords this doctrine any appearance of support, is related of two young men travelling on foot,<sup>2</sup> who arrived about eleven o'clock in the forenoon “heated, but not fatigued,” on the banks of the river Tweed. They stripped instantly and plunged in. The utmost refreshment followed. In the afternoon they proceeded sixteen miles further at a single stretch. The afternoon had been warm and they sweated profusely, but the evening was temperate and rather cool. They had travelled for some miles slowly, and arrived at the end of their journey stiffened and wearied with their exercise. The refreshment experienced in the morning from bathing, induced one of them to repeat the experiment, and he went perfectly cool into the same river. “The consequences were very different. The Tweed which was so refreshing in the morning now felt extremely cold, and he left the water hastily. No genial glow succeeded, but a feverish chill remained for some time, with small frequent pulse and flying pains over the

\* Having scarce entered the water, his limbs began to grow cold with a sudden trembling: then paleness spread over him, and the vital heat almost left his whole body. His attendants took him, like a dying person, in their arms, and carried him, not properly in his right senses, into his tent.—Currie’s Med. Rep. p. 94.

<sup>1</sup> Ibid. p. 94.      <sup>2</sup> Ibid. p. 98.



body. Warm liquids and friction brought on at length considerable heat, and towards morning perspiration and sleep followed." The next day he was extremely feeble, and it was several days before he recovered his usual vigour.

123. This case, unconnected with the others adduced, might be considered as favouring the doctrine that the danger arises from cold applications while the body is cooling after having been heated (117). But we are compelled to reject the idea; 1, because this is the only one of all the cases stated in which there was time to cool before the cold application was made; 2, because in Dr. Currie's tenth experiment, made to ascertain the effects of immersion in cold water, the same effects followed on the application of cold water to a person who had not been previously heated.

124. In this experiment, the bath stood in the open air;<sup>1</sup> the temperature of the air was forty-one and an half degrees; that of the water forty degrees. A young man was immersed to the shoulders in this bath for thirty-four minutes. On coming out, notwithstanding the use of the warm bath, he began to shiver violently, "became sick and very languid, a cold sweat covering his face, his pulse very quick and feeble. He was removed into bed, but passed a feverish night, and next day had wandering pains over his body, with great debility, resembling the beginning stage of a fever. By cordials and rest this went off."<sup>2</sup>

125. The identity of the effects of immersion in cold water, whether the subject of the experiment be previously heated or not, is manifest (122. 124); and the

<sup>1</sup> Currie's Medical Reports, p. 145.

<sup>2</sup> Ibid. p. 158.

conclusion is irresistible, that the danger does not arise from the application of cold to a person becoming cool or losing heat, after having been heated to excess.

126. This erroneous principle has led to a corresponding inference. Dr. Currie considers it "perfectly established, that there is no situation in which the application of cold to the body, whether to the surface or the stomach, is so safe, or in general so salutary, as when the heat of the body from whatever cause is preternaturally great, provided the body is not already in a state in which it is rapidly parting with this heat, and no disease has taken place in the general sensibility, or in the structure of any of the parts."<sup>1</sup>

127. This is a legitimate conclusion from the doctrine advanced (117), but is contrary to the constant experience of this whole country; it being not uncommon to hear of men in the harvest field, stopping to drink out of a spring and dying on the spot. In consequence of these terrible accidents, it has become a practice to wait a while in order to become cool before drinking, and experience has proved it to be the proper plan.

128. Dr. Rush on the other hand, from its being so common for people to suffer in this way from drinking cold fluids, while excessively heated, considered this circumstance essential to the production of the effect; and recommended strongly, that persons who are preternaturally heated, and who will notwithstanding drink cold water, should first cool themselves by washing the hands and face. He asserts that "by the use

<sup>1</sup> Currie's Medical Reports, p. 87.

of these preventives, inculcated by advertisements pasted upon pumps by the Humane Society, death from drinking cold water has become a rare occurrence for many years past in Philadelphia.”<sup>1</sup> That this circumstance, excessive heat, is not essential, is evident from the case of the young man above related (122), and from the tenth experiment of Dr. Currie (124).

129. These dangerous consequences of cold applications appear, therefore, when the body is greatly heated without subsequent cooling (115. 118. 121); when it is cool after having been heated (122); and also without its having been previously heated (124). There is something here inconsistent with the theories of both Rush and Currie.

130. The solution of the difficulty rests on the principle above established (99 to 113), that cold applications to the surface or to the stomach reduce the action of the heart. If these be made, for a short time, when the heart is vigorous, the reduction is quickly followed by increased action (107. 109); but if the action of the heart be already low, the additional reduction by cold applications is so great as to produce almost imperceptible pulse, and even its sudden extinction (9. 115).

131. On applying this principle we shall find it to explain every difficulty in the cases adduced.

In those mentioned by Franklin (115), as well as in the cases stated by Dr. Currie (118 to 121), the persons had been already exposed to the extreme operation of a powerful cause of reduced action of the heart, excessive fatigue (89. 90).

<sup>1</sup> Rush's Works, Vol. 1, p. 195.

In the first case mentioned by Dr. Currie, the young man was excessively fatigued, and could not for some minutes drink for want of breath, and drank as soon as he had recovered it (118). The expressions,<sup>1</sup> in the second, “*nec sudore adhuc aut fatigatione remissis;*”<sup>\*</sup> in the third, “*et sudore respersus ac totus madidus et fatigatus;*”<sup>†</sup> in the fourth, “*corporis totius adaperitis poris madidus;*”<sup>‡</sup> in the fifth, “*exhausted with fatigue;*” in the sixth, “*stooping down after severe labour to drink;*” in the eighth, “*exhaustis viribus et totus sitibundus;*”<sup>||</sup> all show excessive fatigue, sufficient to produce diminished action of the heart in a very great degree.

In the case from Appian (119), the soldiers were excessively fatigued in battle “*et æstuentes,*”<sup>§</sup> when they drank of spring water greedily. In that from G. Tyrius (119), the soldiers were marching through an arid parched country, and of course were hastening forward with all expedition to get to water, (as was also the case with Alexander’s army, of which a striking account is given from Q. Curtius, by Currie,<sup>2</sup>) and were consequently greatly fatigued when they arrived on the banks of the river and drank abundantly.

In the case of Alexander’s army in pursuit of Bessus, across a desert forty-six miles in width, they arrived “*fainting under their toils*” on the banks of the river Oxus (120). Alexander himself, when he nearly

<sup>1</sup> Currie’s Medical Reports, p. 82.

<sup>\*</sup> Neither the sweat nor the *fatigue* having as yet remitted.

<sup>†</sup> And covered with sweat and all wet and *fatigued*.

<sup>‡</sup> Wet from the open pores of the whole body.

<sup>||</sup> With strength exhausted and excessively thirsty.

<sup>§</sup> Literally, *waxing hot, boiling*.

<sup>2</sup> Note to p. 84. Medical Reports.

lost his life by leaping into the Cydnus, was "covered with dust and sweat, and exhausted with long continued toil (121)."

The four young men mentioned by Franklin (115) had "worked at harvest in the heat of the day," an exercise, from the custom of racing in the field, not inferior to any mentioned for violence.

132. In all these cases the vigour of the heart was reduced by continued violent action, the consequence of being vehemently stimulated by the torrent of blood forced into it by long and severe exercise (81.) In this reduced state, it is manifest that the application of a cause, as cold, of itself sufficient speedily to reduce the action of the heart to a dangerous feebleness (124), must be very apt even to extinguish it.

133. On this principle there is no difficulty in explaining the case of the young man who after a day's journey on foot went into the Tweed (122). When he bathed at eleven o'clock in the forenoon, "heated, but *not fatigued*," the reduction of the action of the heart by the water, was just enough to make him feel more pleasant. When in the evening he was "stiffened and wearied," and had been compelled "to travel some miles slowly" from the fatigue of walking all day, the vigour of the heart was so reduced, that, on the additional reduction produced by going into the water, the pulse became "small and frequent," and the patient complained of chilliness and flying pains over the body.

134. It appears then that in every case mentioned by Franklin and Currie (115. 131. 133), previously to the application of cold, fatigue had been suffered sufficient to reduce the action of the heart.



135. Similar effects have followed the application of cold water for a short time, in cases in which the action of the heart was reduced, but not by fatigue. A patient of Dr. Currie's was taken out of bed, shivering in the cold stage of an intermittent, his pulse small and frequent, his extremities shrunk and cold, and cold brine was dashed over him. His breathing was in consequence for some minutes almost suspended; his pulse at the wrist was not to be felt; the pulsations of the heart were feeble and fluttering; a deadly coldness spread over the surface; and when respiration returned, it was short, irregular, and laborious.<sup>1</sup>

136. Continued exposure to cold has the same effect, when the action of the heart has not been previously reduced. This appears from the tenth experiment of Currie (124), on a healthy young man (105). The action of the heart was in its natural state, but the immersion in very cold water continuing a very long time, the same effects appeared as on the application of cold for a shorter time to persons in whom the action of the heart had been previously reduced.

137. The same effects, therefore, proceed from a short exposure to cold, when the action of the heart has been previously reduced; as in the cold stage of fever (135), or by excessive fatigue (131); as from continued exposure, when the action of the heart has not been previously reduced (124). Consequently we must attribute the total or almost total extinction of the action of the heart in those cases, in which persons excessively fatigued have drank freely of cold water, or have been

<sup>1</sup> Currie's Medical Reports, p. 43.

immersed in it, to the joint operation of the two causes ; and may conclude, generally, that the evil effects sometimes observed to follow the sudden application of cold, arise from the operation of this powerful cause of reduced action of the heart, on systems in which the action of that viscus has been previously reduced ; most commonly, but not exclusively (135), by excessive fatigue.

138. Thus it appears that every variety of the operation of cold, is consistent with the general principle, that cold applications to the body lower the pulse and the temperature, and therefore reduce the action of the heart (82. 83.)

139. Cold is one of the most common, and is the most immediately active of the remote causes of fever ; in many cases producing fever in a few hours, independently of the assistance of other remote causes ; as in the cases mentioned above from Currie (122. 124).

140. Most of the causes of disease yet mentioned are limited in their operation. Want of food, or famine, has in many instances produced great mortality. Cold is very extensive in its operation, but its action is so painful that it is carefully guarded against ; and few instances occur of epidemic disease from it alone.

## CHAPTER III.

### OF THE REMOTE CAUSE OF THE EPIDEMICS OF HOT WEATHER.

141. THE inquiry into the cause of the epidemics of hot weather, and all the interesting questions connected with the subject, are of incalculable importance. For thirty years the discussion has almost engrossed the attention of the medical world. A multitude of facts, scattered through the writings of past ages, as well as a very great number ascertained by the care and attention of the present, have been brought to bear on the subject, and have thrown much light on it; but it seems notwithstanding, for a few years past, to be rather more unsettled than it was.<sup>1</sup> When facts abound, all that is wanting to ascertain the truth, is a careful induction of such inferences as clearly flow from them. I shall endeavour to proceed in attempting this investigation, cautiously yet firmly.

142. Hot weather in a large portion of the earth, is the time of the greatest mortality; and hot countries are the special seat of epidemic diseases. Here alone they display all their terrors; as we travel north we find them less common and less violent; and the colder countries are comparatively healthy.

<sup>3</sup> See the editorial remarks, No. 13, p. 1, of the Philadelphia Journal of Med. and Phys. Sciences; the paper of Ferguson to which they are prefixed; and Chapman on Epidemics, No. 16, p. 366, of the same Journal.

When raging with their utmost violence in the autumnal months, a stop is put to their further progress by frost, and by the accompanying cool winds from the north, in those countries far enough north to enjoy this benefit: whereas within the tropics no season is exempt from their occasional appearance, and in some parts they prevail throughout the year.<sup>1</sup>

Heat, therefore, is plainly essential to the existence of these diseases.

143. Heat alone, however, in the degree usual in the hottest climates, is not sufficient to produce epidemics. Lind states that the dry season in Senegal, the hottest part of the year in that country, is healthy. The Arabs of the great desert of Africa are healthy; and the diseases of Egypt never spread into the neighbouring deserts occupied by the Bedouin Arabs.<sup>2</sup> The West India islands vary exceedingly with regard to health. Barbadoes is comparatively healthy, while Jamaica and Hayti are very sickly. The latter are five degrees farther north than Barbadoes. Our hottest seasons are, in many situations, often the healthiest; the fore part of the summer is generally healthy; and during the prevalence of an epidemic in hot weather, many places escape at a very short distance from those which suffer severely.

These partial effects show the operation of a partial cause, while heat is general in its action. Heat alone is therefore not the cause of the epidemics of hot weather.

144. The hot countries within the tropics, in gene-

<sup>1</sup> Lind on Hot Climates, p. 34. Hillary, p. 108.

<sup>2</sup> Assalini, p. 66. Burkhardt's Travels, Quart. Rev. No. 41. p. 144.

ral healthy during the hot and dry season, become sickly soon after the rains commence. Lind, speaking of Guinea, says, "This, as most tropical countries, has, properly speaking, only two seasons, the wet and the dry; the former is commonly of about four months' continuance, and is the season of sickness; whereas for many months in the dry season, most parts of this country are equally healthy and pleasant with any in the world."<sup>1</sup> No sooner, however, do the rains set in than the ravages of disease commence, and continue throughout the wet season, and afterwards until the abundant moisture is evaporated.<sup>2</sup> As soon as this is effected, the health of the country is restored, except in those places which continue wet throughout the year. The rainy season and the sickly season are synonymous terms.<sup>3</sup>

This agrees with what is observed in Europe and America. Dr. Wind, a Dutch writer quoted by Lind, states, that at Middleburg, the capital of West Zeeland, a disease generally reigns toward the end of August or the beginning of September, which makes its appearance after the rains which generally fall in the latter end of July, and is always most violent after hot summers.<sup>4</sup>

In this country precisely the same thing occurs. Hot and wet seasons are the most sickly; and dry seasons, though hot, are healthy. Thus the wet years 1804, 1821, 1823, were very sickly, and the very dry year 1822, healthy; and although in very dry seasons some places are very sickly, these are uniformly situa-

<sup>1</sup> Lind on Hot Climates, p. 32.      <sup>2</sup> Ibid. p. 35. 37. 41. 49.

<sup>3</sup> Ibid. p. 60. 68. 71.      <sup>4</sup> Ibid. p. 19.



ted near water courses, or marshes; of this Harper's Ferry and Shepherdstown, on the Potomac river, are striking instances. Examples of this kind might easily be multiplied. Moisture, therefore, is also essential to the production of these diseases.

145. Heat and moisture, however, though both essential, are not sufficient to produce them.

Vessels at sea, or at a small distance from land, in the hottest climates, even in the rainy season, continue healthy if they be kept clean. Many instances are mentioned of vessels in port, immediately on the appearance of disease among their crew, pushing out to sea with the effect of immediately stopping its progress.<sup>1</sup> Lind, from experience of this, even advises those who are able, to retreat to floating habitations during the sickly season.<sup>2</sup>

Instances have often occurred of a superabundance of moisture in hot weather being favourable to health. Pringle tells us that the air of Brabant, in 1748, when the neighbourhood of the towns had been inundated as a protection from the enemy, "sensibly became more noxious upon letting off part of the water, in the beginning of summer, after the preliminary articles of peace were signed;" and that the states of Holland, being made sensible of this by the sickness which raged at Breda, gave orders to let in the water again, and to keep it up until winter.<sup>3</sup>

In the autumnal season of 1798, in Boston, the inhabitants contiguous to a mill-pond in the town were very sickly. This pond was often drained of its water,

<sup>1</sup> Lind on Hot Climates, p. 89. 132. 133.

<sup>2</sup> Ibid. p. 118, 120. <sup>3</sup> Diseases of the Army, p. 62.

so as to leave the mud and putrid substances exposed to the action of the sun. The selectmen were requested to order the water to be retained constantly in the pond; which being done, the fever soon ceased in that quarter.<sup>1</sup>

146. Excessive rains have often produced the same effect. "Dr. Dazilles, in his treatise upon the diseases of the negroes in the West Indies, informs us, that the rainy season is the most healthy at Cayenne, owing to the neighbouring morasses being *deeply* overflowed."<sup>2</sup>

Dr. Rush states in his account of the autumnal fever of 1795, in Philadelphia, that "on the 30th and 31st of August, there was a fall of rain, which suddenly checked the fever of the season, insomuch that the succeeding autumnal months were uncommonly healthy."<sup>3</sup>

The same occurred in the county of Loudoun, Virginia, in 1804. The summer of that year was the wettest ever known by the people then living; a severe epidemic followed; but on the low grounds of the Potomac, usually very sickly, which were that year almost continually under water, the cases were much milder than on the upland.

In the island of Trinidad, the centre of which is a vast morass, an abundance of rain is salutary. Dr. Ferguson calls them preserving rains,<sup>4</sup> because a deficiency is sure to be followed by sickness. He also says, "In the island of St. Lucia, the most unwholesome town of Castries, at the bottom of the Carenage, which is altogether embosomed in a deep mangrove

<sup>1</sup> Medical Repository, Vol. 2. p. 466.

<sup>2</sup> Rush's Works, Vol. 3. p. 108.

<sup>3</sup> Ibid. p. 243.

<sup>4</sup> Philadelphia Journal, &c. No. 13. p. 8.

fen, became perfectly healthy under the periodical rains."<sup>1</sup>

He further states, that "a year of stunted vegetation, through dry seasons, and uncommon drought, is infallibly a year of pestilence to the greater part of the West India colonies."<sup>2</sup> Therefore a rainy year is healthy in the West Indies generally. Lind makes the very same statement of the island of Sardinia.<sup>3</sup>

Heat and moisture are not therefore sufficient to produce epidemic diseases.

147. In order to ascertain what more is wanting, let us look into the situation and circumstance of those places most liable to these diseases.

In the tropical countries, those spots where sickness prevails throughout the year, as Benin, New and Old Calabar, &c. are low and marshy.<sup>4</sup> Those cities and stations in Africa, Asia, and America, which have been the graves of unnumbered thousands, are situated near marshes, or at the mouths, or on the banks of rivers in flat countries, which in the rainy season become one vast morass. In more temperate climates, similar spots are the seat of similar diseases in the summer and fall. Such are the Campagna di Roma, and many other parts of Europe. Such, in the United States of America, are the rice swamps of the south, and the swampy countries of the sea coast from Delaware bay southward. If we look around us in our own immediate neighbourhood, we shall observe the same. The marshes, the river bottoms, rendered similar to marshes by the heat of summer, the artifi-

<sup>1</sup> Philadelphia Journal, &c. No. 13. p. 8.      <sup>2</sup> Ibid. p. 9.

<sup>3</sup> Lind on Hot Climates, p. 21.      <sup>4</sup> Ibid. p. 34. 120.

cial morasses produced by building mill-dams, are the spots noted for disease. Of this every neighbourhood affords instances.

148. On the other hand, places situated at a distance from marshes or low grounds are comparatively free from disease.

At the sickly settlement of Bencoolen, in Sumatra, very few of the English survived any length of time, until they built a fort on a dry elevated situation, at the distance of about three miles from the town, which afforded a tolerably safe retreat.<sup>1</sup>

The Dutch, at Batavia, one of the most unhealthy spots on the earth, made an excellent road from the city to the mountains for the benefit of convalescents.<sup>2</sup>

"The English, at Bombay, enjoy the benefit of having several rising grounds near them, from whence, during the rainy seasons, they may in safety behold the adjacent country covered with water."<sup>2</sup>

Lind mentions St. Thomas's mount, within nine miles of Madras, as the Montpelier of the English settlements in India, and calls it a paradise of health.<sup>2</sup> He speaks also of "Monk's Hill, as affording a safe retreat from sickness in Antigua."<sup>3</sup>

Centreville, in Fairfax county, Virginia, is situated on elevated, dry, slaty land; it may be seen from a great number of places for many miles around. In the sickly autumn of 1821 there occurred, Dr. Lane of that place informed me, but two cases of fever in the town, although the sick in the neighbourhood, in which there are large streams and extensive low grounds, were so numerous, that he scarce had time to sleep.

<sup>1</sup> Lind on Hot Climates, p. 60. 152. <sup>2</sup> Ibid. p. 153. <sup>3</sup> Ibid. p. 148.

On inquiring into the source from whence these two persons could have derived the fever; one, Mrs. L., had spent three weeks at the house of a friend who lived near an old mill-pond, and was taken sick soon after returning home. The other was a paralytic female who sat listening to our conversation. She stated that there was a pond in her yard; that she was in the habit of sitting for hours together near a back door for the benefit of air, and that the wind was blowing immediately over the pond upon her, at the moment she felt the chill which ushered in the attack.

149. Places formerly healthy, have often been rendered unhealthy by an artificial morass, as is witnessed in every neighbourhood when a mill-dam is built.

Harrisburg, in Pennsylvania, situated between the Susquehannah river and a small creek, and extending nearly or quite from one to the other, afforded, in the year 1793, a striking example of this. In that year a dam was built across the creek in the rear of the town, whereby was produced a very extensive and shallow pond. In the autumn succeeding, a mortal fever prevailed in the town, which the people attributed to the pond; and they insisted on having the dam removed. With some difficulty they succeeded; the pond was completely drained, and the town was as healthy afterwards as it had been before.

Lind states that the Arabs are in the habit of revenging themselves on the Turks of Bassora, by breaking down the banks of the river Tigris, with a design to cover the neighbourhood with water; the consequence of which always is a mortal fever.<sup>1</sup>

<sup>1</sup> Lind on Hot Climates, p. 78.



150. Places in the neighbourhood of marshes, formerly unhealthy, have been rendered healthy by draining the marshes, and have again become unhealthy on suffering the drains to fill up.

Dr. Lane informed me that the family of one of his friends had been remarkably unhealthy for years. In 1821 the autumnal fever began in this family very early. He told his friend that he considered an old mill-pond near the house as the source of the evil, and advised him to have it drained. It was done without delay; and as soon as the bottom became dry, the family became healthy, even before the sickly season had passed over.

“Calcutta, built literally on a swamp on the east side of the Hoogly, and surrounded to this moment by immense lakes at a few miles distance, has, by the draining of that part of the city inhabited by Europeans, become as healthy as any country of the same latitude on earth. Ten miles below the city, where the country is not cleared, and the rapidity and rankness of the vegetation is suffered to infect the air, the jungle, or violent bilious fever, is sure to attack every one who comes for a time within its atmosphere; yet the old village of Fultah, while the Dutch had an establishment there, was healthy, because the ground was cleared; since they have left it, it has become once more unhealthy.”<sup>1</sup>

151. The evil consequences of continuing near a swamp are often experienced by the crews of ships, particularly in hot climates. “It was observed, that during the summer and autumn of 1765, when fevers

<sup>1</sup> Lind on Hot Climates, p. 65. note.

raged at Portsmouth, and in such ships as lay in that harbour near the mud, the men who were in the ships at Spithead enjoyed perfect health.”<sup>1</sup>

Lind says he was “informed by Mr. Martin, surgeon of the *Cataneuch*, a Guinea trader, that when he was in Gambia river, in company with four other ships, the men, in one of those ships, were daily taken ill of fevers and fluxes, and several of them died delirious; while all the English in the other ships, and in the factories, were in perfect health: but upon removing that ship about half a league from her first anchorage, which was too near some swamps, her men became as healthy as those in the other ships.”<sup>2</sup>

152. We find then that in all parts of the temperate zones, and between the tropics, marshes are particularly favourable to the production of fevers.

153. It is sometimes objected to this doctrine, that some marshy situations are generally healthy, and that others are generally sickly; also, that the former sometimes suffer severely from epidemic fevers, while the latter sometimes escape. These are undoubted facts; but when investigated, instead of weakening, they are found to strengthen the doctrine.

154. Marshy situations, generally healthy, have become sickly during a very dry season. A marsh covered deep with water, or a mill-pond well filled and exposing no marshy surface, may have produced no injury for years. A very dry season, by evaporating the water, and exposing the bottom to the action of the sun, renders the neighbourhood sickly. The effect of such exposure may be estimated by what has

<sup>1</sup> Lind on Hot Climates, p. 118.      <sup>2</sup> Ibid. p. 120.

been stated of Holland and Boston (145). Senac mentions an instance in which the bottom of a pond was brought into view in a different manner, but with the same result. "Near to the walls of a large city stood a very extensive and deep pond of water, which for forty years had served as a receptacle of all the filth from the houses and streets. As long as these putrid matters remained covered with water, they were productive of no mischief. But when they had so far accumulated as to rise above the surface of the water, a most malignant fever spread through the tract of country adjoining the city."<sup>1</sup>

155. The same cause, hot weather, in different circumstances, produces effects precisely opposite. A marshy spot, which has heretofore rendered a neighbourhood sickly, may be dried up, and the consequence is health. On the 23d of July, 1821, so great a quantity of rain fell in Fauquier county, in Virginia, that about twenty mill-dams were broken down in the course of the day and following night. The weather was afterwards very dry. In a short time the mud left on the bottom of the ponds, was so dry that a spade could be thrust down into the large cracks, which appeared to extend to the very bottom of the accumulated sediment. During the time these ponds were drying, bilious vomitings and diarrhœas, and also some most violent cases of bilious remittent fever, occurred among the workmen employed in rebuilding the dams, and those who lived near. But after they became perfectly dry, it was universally observed that we never had had so healthy an autumn.

<sup>1</sup> Caldwell's translation of Senac on Fevers, p. 20.

156. Very wet weather will produce the same beneficial effects on marshy places ordinarily sickly, by covering them from the action of the sun. Of this several instances have already been given (146). Between Winchester and Charlestown, in the valley of Virginia, is a remarkably large and deep spring, from which extends a low marshy piece of ground about a mile long, and perhaps one hundred yards wide. All around this marsh the people have been annually subject to fevers in an unusual degree. In the very wet year 1823, however, the marsh being inundated, they almost entirely escaped. This is also exemplified by the measures adopted in Brabant, and in Boston, to obviate the effects of marshy spots (145). In these instances the inundation of the neighbouring marshes, put an end to the prevailing sickness.

157. The effect of a marshy soil is strikingly manifested when that state is only temporary. If a country, ordinarily dry and healthy, in consequence of very wet weather, become marshy in hot weather, epidemic fever will certainly follow. This was exemplified in the years 1804, 1821, and 1823, in the country above and below the Blue Ridge. In these years, particularly in the first and last mentioned, the quantity of rain was unexampled in the memory of most persons; as was also the general prevalence of autumnal fevers.

158. A gentleman living on the ridge land between the Opequon and the Shenandoah river, informed me that he had, for nineteen years before 1823, scarcely known what sickness in his family was. A neighbour had been in the habit for many years of watering his

meadow by small rills from his mill-race. Before this wet year, the quantity he could spare was very small, and not enough to make the ground wet. This year, however, it was quite marshy, and the road through it miry. The consequence was, a great number of persons died in the houses just around the meadow.

159. Thus we see that excessive heat, by drying up the moisture in a marshy tract of country, will make it healthy (155); or, by making a marsh of a pond formerly well filled, will produce unusual sickness (154). On the contrary, that excessive rain will fill a country hitherto dry and healthy, with marshy spots, and produce fatal disease (144. 157. 158); or, will cover from the action of the sun extensive marshes, and prevent the evil which would otherwise have followed (156).

160. We find, then, that the objections are founded on a partial view of the subject, and that all the facts confirm the doctrine that marshes are the special seat of epidemic fevers.

161. The following facts shed still more light on the subject.

“Lancisius relates that thirty gentlemen and ladies of the first rank in Rome, having made an excursion upon a party of pleasure towards the mouth of the Tiber, the wind suddenly shifted, and blew from the south *over the putrid marshes*; when twenty-nine were immediately seized with a tertian fever, one only escaping.”<sup>1</sup>

162. Lind, speaking of a settlement formed by the English on the island of Balambangan, near Borneo, says, “For a few months these people continued in

<sup>1</sup> Lind on Hot Climates, p. 21.



perfect health; but no sooner did the monsoon change, than sickness made its appearance; and it raged with such violence that scarce one in ten survived this monsoon." "The seasons of health and sickness are here regulated by the direction of the wind or monsoon; from October until April, during the northeast monsoon, the wind comes from the sea, and the settlement is perfectly healthy; but from April until October, during the southwest monsoon, the wind blows *over the marshes*, both of this island and of Borneo, and produces fevers of a most malignant nature, which frequently cut off even the stoutest men in twelve or fourteen hours."<sup>1</sup>

163. A very fatal fever prevailed at Galliopolis, in Ohio, in the summer of 1796. Major Prior, of the army, witnessed the rise and progress of the disease. He visited Baltimore in September, 1797, and made for Dr. Potter the following written statement of the circumstances. "As the garrison was severely afflicted by this fever, I could but take great interest in it. The fever was, I think, justly charged to a large pond near the cantonment. An attempt had been made, two or three years before, to fill it up by felling a number of large trees that grew on and near its margin, and by covering the wood thus fallen with earth. This intention had not been fulfilled. In August the weather was extremely hot, and uncommonly dry; the water had evaporated considerably, leaving a great quantity of muddy water, with a thick slimy mixture of putrefying vegetables, which emitted a stench almost intolerable. The inhabitants of the

<sup>1</sup> Lind on Hot Climates, p. 74. 75.

village, principally French, and very poor as well as filthy in their mode of living, began to suffer first, and died so rapidly that a general consternation seized the whole settlement. The garrison continued healthy for some days, and we began to console ourselves with the hope that we should escape altogether; we were, however, soon undeceived, and the reason of our exemption heretofore was soon discovered. The wind had blown the air arising from the pond *from the camp*; but as soon as it shifted to the reverse point, the soldiers began to sicken: in five days half the garrison was on the sick list; and in ten, half of them were dead.”<sup>1</sup>

Examples under each of the preceding heads might easily be multiplied.

164. The inference from these facts, that a vapour or gas, produced in marshy places, is the cause of the epidemic fevers of hot weather, is irresistible.

165. It has been objected to this doctrine that the inhabitants of elevated situations are sometimes harassed with autumnal fevers. Thus, a fever prevailed in the year 1823 on a part of the Blue Ridge in Jefferson county, Virginia.

At the western foot of this mountain flows the river Shenandoah. Between the river and the mountain there is some river-bottom land. The land is cleared and cultivated to the top of the mountain. That year was uncommonly wet and sickly throughout the valley of the Shenandoah. There are, moreover, a great number of obstructions in this river, made of stone, and passing obliquely downwards nearly to the oppo-

<sup>1</sup> Potter's Memoir on Contagion; also, Medical Recorder, 1. 527.

site side, in order to throw the water to one side, and increase the depth of it for the improvement of the boat navigation. These obstructions have produced a number of shallow places, and marshy spots at the edge of the river.

It is evident from this statement that the circumstances are perfectly adapted to the production of the gas in question: and it is equally evident, that the relative position of the river and the mountain is such, that the westerly winds, which are prevalent throughout the autumnal season, must carry the gas arising from the marshy spots about the river, directly up the mountain; as it did in the cases just stated, upon those who were to leeward of the marshes (161 to 163).

166. Marshes, during the heat of the summer and autumn, when these diseases appear, abound in putrefying vegetable matter, whence proceeds an abundance of gas. All the circumstances favouring the prevalence of epidemics, are such as peculiarly favour the putrefaction of vegetable matter. Thus heat and moisture are both necessary (142. 144); but such a degree of heat as, by drying up a marsh, puts an end to the putrefaction of vegetable matter therein, puts an end also to the prevailing epidemic (155); or such an abundance of moisture as by covering the vegetable matter, and protecting it from the action of the sun, checks or puts an end to putrefaction (156), produces the same effect. Further, as long as there remains any moisture in a marshy place, the greater the heat, and therefore the greater the putrefaction, the more violent the epidemic: while frost, which puts an end to putrefaction, puts an end to the epidemic.

There is, therefore, very strong evidence that the gas driven by the wind from marshy places, which is the cause of epidemic fevers (163. 164), is the product of the putrefaction of vegetable matter.

167. This is corroborated by the occurrence of such diseases when vegetables in bulk, as potatoes, &c. are suffered to putrefy.

The first cases of the fever of 1793, in Philadelphia, originated at a wharf, on which, and into the adjoining dock, had been thrown from the hold of a ship a quantity of coffee in a putrid state. The disease spread first through those alleys and streets which were in the course of the winds that blew across the dock and wharf where the coffee lay in a state of putrefaction.<sup>1</sup>

168. "The holds of all vessels, particularly ships of war, contain large quantities of vegetable matter, in casks often insufficiently strong to prevent their contents from escaping; such as pease, oatmeal, cocoa, flour, sugar, and wood for fuel, and when united with a due proportion of humidity, so as to produce a given change by putrefaction, a gas is evolved, under a certain degree of atmospheric temperature, highly detrimental to animal life,"<sup>2</sup> &c. Many instances can be produced of the air of the holds of ships becoming so impure that candles will scarcely burn in them.<sup>3</sup>

169. The ship *Antelope* arrived at Barbadoes in March. Immediately afterwards, when the inhabitants of Bridgetown were perfectly healthy, a fever appeared on board; there were one hundred and ten

<sup>1</sup> Rush's Works, Vol. 3. p. 43. 109.

<sup>2</sup> Bancroft's Sequel, p. 233. <sup>3</sup> Ibid. p. 232.

cases, of which thirty-one ended in death.<sup>1</sup> In consequence of this she was cleaned out, when it was found that "a combination of the above vegetable substances" (168), with the bark of green wood and chips in a state of putrefaction, occupied a considerable portion of the hold; and "those individuals who had hitherto resisted the influence of this miasm, now suffered in clearing away a mass of highly putrid and offensive matter. Even some of the government slaves, who have ever been exposed on similar duties, employed here, experienced the noxious effects of this effluvium, and narrowly escaped by being sent to the hospital."<sup>2</sup>

170. The ship Childers arrived at Barbadoes on the 26th of August, 1816, with twenty-six sick; twenty-one had died in ten days. In the next four days there were twelve new cases; there were never less than three new cases in each of the five following days, when she was blown out to sea with only fifteen effective hands.<sup>3</sup> She arrived at Antigua, and was ordered to be purified; when the hold of the ship was found to be in a most extraordinary state of filth, fermentation, and impurity.<sup>4</sup> The seamen declared that on different occasions when they were sent there, the candles would not burn.<sup>5</sup> After her purification she continued perfectly healthy, though she took many fresh hands on board.<sup>6</sup>

171. The ship Regalia left Guernsey in November, 1814, and arrived on the coast of Africa in February, 1815, full of troops in perfect health. She was employed from that time until the latter end of June in

<sup>1</sup> Bancroft's Sequel, p. 235. <sup>2</sup> Ibid. p. 233. <sup>3</sup> Ibid. p. 228. 229.

<sup>4</sup> Ibid. p. 230. <sup>5</sup> Ibid. p. 232. <sup>6</sup> Ibid. p. 231.



removing troops and stores from one post to another. At this time she took in a supply of green wood, which was "cut down and brought on board the same day,"<sup>1</sup> in such quantity that after she had been in the West Indies several weeks, there was enough left for a voyage to Europe.<sup>2</sup> The ship was rather leaky.<sup>3</sup>

She sailed from Africa with black troops for Barbadoes on the 18th of July, and arrived a little before the 24th of August. There was a considerable mortality on the passage. There were only seven hundred and fifty-three of these black recruits originally, who were distributed among four transports, the *Regalia* and three others.<sup>1</sup> After their arrival in the West Indies, between the 24th of August and the 24th of October, the *Regalia* sent to the hospital one hundred and eleven cases of flux, of which fifty-three proved fatal; the other three transports sent only one hundred and seventy-seven, of which only seventeen terminated in death.<sup>4</sup>

172. The crew began to sicken in a fortnight after the wood was laid in. One died before sailing; two the day after; the men continued to "fall ill" until all but two had suffered attacks, and five out of twenty-one died before her arrival at Barbadoes. A military officer and his wife died on the passage; the captain's wife after making the harbour; and the captain himself immediately after. At English harbour, Antigua, she was fumigated, and after three days' detention returned to Barbadoes. During this short voyage three newly entered hands sickened; one died, and two were

<sup>1</sup> Bancroft's Sequel, p. 218.    <sup>2</sup> Ibid. p. 224.

<sup>3</sup> Ibid. p. 226.    <sup>4</sup> Ibid. p. 219.

sent to the hospital. On her arrival three more sickened, one of whom had lately entered, and one died.<sup>1</sup>

173. The hold was now ordered to be cleaned out: every thing was taken out, and the hold was exposed to the concentrated heat of stoves, the hatchways being closed. About the time this was commenced, of three men newly shipped, two sickened, of whom one died; and the cook, upwards of fifty years of age, sickened and died.<sup>2</sup>

174. After having undergone the above thorough cleansing, "she sailed from Guadaloupe, crowded to a very great degree with French prisoners and their families from the jails, under the most dangerous circumstances to health, with a case of yellow fever actually dying on board the day before she left Basse-terre roads, but without communicating any such fever to the unfortunate passengers."<sup>3</sup>

175. This vessel, before this great quantity of green wood was shipped, was healthy (171). A fortnight after sickness commenced, affected almost every soul on board, killed about one-third, and attacked almost every one who was shipped in place of those who had perished. After a thorough cleansing, she sailed with a crowd of prisoners taken out of jail, and no fever arose among them.

176. These facts, and many more abounding in medical works, confirm the inference, that a gaseous fluid, the product of the putrefaction of vegetable matter (166) abounding in marshes, and other places (167 to 175), is the cause of epidemic diseases.

177. This gas is dense, or it would arise from the

<sup>1</sup> Bancroft's Sequel, p. 220. 221. <sup>2</sup> Ibid. p. 222. <sup>3</sup> Ibid. p. 223.

earth and not be driven along its surface by the wind (161 to 163). Numerous facts show that it is so. Domestic animals first feel the effects of its presence in the air. Those persons who inhabit the lower stories of houses, are much more liable to the attack of an epidemic fever, than those who inhabit upper stories. Dr. Ferguson in his essay on marsh poison says, "According to official returns during the last sickly season at Barbadoes, the proportion of those taken ill with fever, in the lower apartments of the barracks, exceeded that of the upper by one-third throughout the whole course of the epidemic."<sup>1</sup> He also says, that "the deep ditches of the forts, even though they contained no water, and still more the deep ravines of rivers and water courses, abounded with the malarious poison. At Basseterre, Guadeloupe, a guard-house placed at the conflux of the inner and outer ditch of the fort, infallibly affected every white man with fever that took a single night guard in it; and the houses that were built in the ravine of the river Aux Herbes, (a clear rapid mountain stream that runs through the town,) or opposite to its 'bou-chure,' proved nearly as unhealthy as the guard-house above mentioned."<sup>1</sup>

178. The evidence, therefore, is positive, that a dense gas proceeding from marshy places, or driven from them by the wind, is the cause of the epidemics of hot weather (161 to 163. 177); and there is the strongest reason to believe, that it is the product of the putrefaction of vegetable matter (166 to 176).

179. These diseases have also been frequently at-

<sup>1</sup> Philadelphia Med. and Phys. Journal, No. 13. p. 18.

tributed to exhalations arising from putrefying animal matter, or from a mixture of animal and vegetable matter. Bancroft has, however, stated a number of facts which seem decisive that such exhalations are not productive of epidemic fevers.

180. He states that complaints having been made of offensive smells from an old grave yard in the midst of Paris, it was determined to remove the mass that had accumulated in the course of ages, so as to reduce the yard to the level of the neighbouring streets. Nearly twenty thousand bodies, in different stages of putrefaction, were disinterred and removed. In the course of this operation, the men were sometimes suddenly thrown down by the concentrated vapours which escaped from bodies penetrated by the spades; but notwithstanding, no fever was produced, though much of this was done in the hottest weather.

181. During the epidemic fever of 1800, in Spain, there were buried in one of the burying grounds of Seville ten thousand bodies, and twelve thousand in three others. In the hot weather of the following spring, the earth which covered these bodies cracked open and suffered a fœtid odour to exhale. In Cadiz the churches were more or less filled with putrid emanations from the same cause. In neither instance did an epidemic follow.<sup>1</sup>

182. The philanthropic Howard, in his work on Lazarettos, says, "The governor, at the French hospital at Smyrna, told me, that in the last dreadful plague there, his house was rendered almost intolerable by an offensive scent, especially if he opened any

<sup>1</sup> Bancroft on Fevers, p. 95. &c.

of those windows which looked toward the great burying ground, where numbers were left, every day, unburied; but that it had no effect on the health of himself or his family. An opulent merchant, in this city, likewise told me that he and his family had felt the same inconvenience without any bad consequences."<sup>1</sup>

183. An instance is given of a man, his wife, and two sons, living ten years in good health in a room under the anatomical buildings of St. Bartholomews. The adjoining passage had in it a number of tubs for the maceration of bones; and other rooms of the cellar, communicating with it, contained large excavations for receiving the refuse of the anatomical rooms. In consequence of this state of things, the whole place was constantly filled with a close cadaverous smell. The whole family spent the day and slept in this confined and noisome place. The man was constantly occupied in the dissecting rooms, cleaning bones and handling the most putrid matters. He always enjoyed good health, as did the rest of the family.<sup>2</sup>

184. Several other strong cases are mentioned of putrid exhalations from manufactories of gluc and catgut, from boiling blubber in a very offensive state; from manuring fields extensively with quantities of fish, and from the manufacture of adipocire, without the production of fevers among the workmen.

In an establishment for the last purpose at Conham, near Bristol in England, the entrails and useless parts of many hundred carcasses were left to putrefy on the surface of the ground; and though the effluvia were very offensive to all employed in the manufactory, the

<sup>1</sup> Bancroft on Fevers, p. 97.      <sup>2</sup> Ibid. p. 420.



health of no one was injured in the two years the establishment was continued.<sup>1</sup>

185. If such exhalations were capable of producing epidemic fevers, every severe battle should be followed by one in the neighbourhood in which it is fought; particularly as the bodies of the slain are often left to putrefy on the surface of the earth. It is alleged indeed, that they have arisen in such circumstances.<sup>2</sup> As, however, they often do not, there must be some other cause in action in those cases in which they do. What this is may be gathered from the situation of those places in which armies are often posted, and battles often fought, viz. in the neighbourhood of a river or of a swamp for the sake of the support afforded by them; or of besieged cities on large rivers, sometimes purposely surrounded with inundations (145).

186. This may be illustrated by the following statement of Pringle, and answer of Bancroft. The former states from Forestus, that "a malignant fever broke out at Egmont, in North Holland, occasioned by the rotting of a whale that had been left upon the shore."<sup>3</sup> The latter observes that Egmont is nearly surrounded by marshy or low grounds, and to the miasmata from these he attributes the fever; "because whales have not been found capable of producing such effects in later times, and because fevers from marsh effluvia constantly fall under our observation." In support of the former reason, he refers to an account by Dr. Gordon of a whale which putrefied at the island of Santa Cruz, without producing any evil effect.<sup>1</sup>

<sup>1</sup> Bancroft on Fevers, p. 422.

<sup>2</sup> Pringle on Diseases of the Army, p. 320.      <sup>3</sup> Ibid. p. 321.

187. Here is strong ground for believing that exhalations from putrid animal matter do not produce epidemic disease. The fever at New London, in Connecticut, in 1798, has however been very confidently attributed to this cause.

188. The situation of that city is "elevated, with scarcely any low grounds to generate marsh miasmata."<sup>1</sup> The disease originated within a kind of parallelogram, formed by four or five stores, containing large quantities of fish imperfectly cured, and within that space and one hundred yards from it, in several directions, it mostly prevailed.

Within that space nothing was observed more than in the other parts of the town, except a large quantity of imperfectly cured codfish stored in bulk.<sup>2</sup> In one store only, fifty quintals were found in a state of fermentation, and emitting a very disagreeable odour. In addition to this foul matter, another account states that there was a very offensive privy belonging to the house in which the fever first appeared;<sup>3</sup> and also a parcel of damaged clams which were thrown from the same house.<sup>4</sup>

189. The weather was excessively hot. The summer of 1798 exceeded in temperature, both as to intensity and duration, any season in the knowledge of the oldest inhabitant. The average of forty-seven observations of a thermometer, in the open air in a northern shade, at different hours from midday to five P. M. was within a very small fraction of 88 degrees. The lowest mentioned was 78, the highest 97

<sup>1</sup> Medical Repository, New York, Vol. 2. p. 402.

<sup>2</sup> Ibid. p. 408.

<sup>3</sup> Ibid. p. 405.

<sup>4</sup> Ibid. p. 472.

degrees. It was also unusually dry and calm for five or six weeks in succession, with the exception of only a few nights.<sup>1</sup>

To the effluvia arising from the operation of this excessive heat on the codfish, the fever has been pretty generally attributed.

190. It is however to be inferred from the expression above quoted (188), that New London has some low grounds whence marsh miasmata are of course, in hot weather, evolved. The fever broke out also near the wharves; and on the wharf adjoining the house in which the first cases appeared, there was "a heap composed chiefly of the dung of cattle, with the sweepings of the decks of vessels," &c.<sup>2</sup> It may be observed that the permitting such a mass of filth to remain on a wharf indicates considerable inattention to such things, and affords reason to believe that there were other collections of the kind not adverted to, in consequence of the inhabitants not being as familiar with the evil effects of such collections, as we are farther south. In such circumstances, the uncommonly hot summer of 1798 produced an epidemic similar to what a burning sun has often, farther south, produced, when there was not a codfish to be seen, or any such collection of putrid animal matter. The same hot weather produced a similar fever in many places of the interior of New England in the same summer. In New York and Boston, in the same season, this fever prevailed. In both these places, besides an abundance of filth of other kinds, there were quantities of spoiled beef and fish; while in Philadelphia, and further south, where

<sup>1</sup> Medical Repository, New York, Vol 2. p. 406.    <sup>2</sup> Ibid. p. 472.

the fever also prevailed, there is no mention of spoiled beef and fish.

191. As therefore sources of miasmata existed in New London, similar to those existing in Philadelphia and other cities more to the south, and as the putrid animal substances, to miasmata from which the fever in New London was attributed, did not exist in those southern cities, it is evident that this case cannot be relied on to support the doctrine supposed to rest firmly on it.

192. The following from Bancroft affords strong reason to believe that exhalations from spoiled beef cannot produce such an epidemic. Dr. Gordon, in the paper above alluded to, gives "an account of the putrefaction of one thousand barrels of salted beef, at the same island, which were finally ordered to be thrown into the sea; and were thus disposed of without having occasioned sickness to any person in the house, store, or neighbourhood, where this putrefaction had taken place and subsisted."<sup>1</sup>

193. With regard to spoiled fish the evidence is equally strong. It is the custom of many countries, where fish abound, to manure their fields with them. This is more especially the case in the more temperate climates, as England and the northern part of the United States. Such is the plenty of fish in our rivers, that, at most fisheries, great heaps almost every year putrefy for want of purchasers. But no epidemic fever has ever been known to arise on such occasions.

194. It is further to be considered that the quantity of animal matter lying on the surface of the earth

<sup>1</sup> Bancroft on Fevers, p. 422.

is exceedingly limited ; being eagerly devoured by a variety of birds, beasts, and insects in constant pursuit of it. On the contrary, that vegetable matter every where abounds ; and particularly in those places in which epidemics appear.

195. It is also to be considered that the gases arising during the putrefaction of animal matter are exceedingly offensive ; and that in places in which a fever prevails, there is frequently little smell, and often none. There must therefore be, in such situations, a very small proportion of the gases which arise from putrefying animal matter ; and it cannot be believed that so small a quantity produces the effects observed in epidemic seasons, when corresponding effects are not observed when these gases are abundant. If an epidemic fever be produced by so small a quantity of these gases that they can scarce be perceived, what terrible consequences should follow when a town or neighbourhood is annoyed for months by a most offensive smell ?

196. Bad drinking water has also been considered the cause of these epidemics. One consideration alone will show this is not correct. Epidemics occur in hot weather particularly, and therefore nothing present throughout the year can be the cause of these diseases. It may further be mentioned that the valley of the Shenandoah, in Virginia, has broad veins of limestone and of slate land running through it lengthwise, the division line being so strongly marked that it must be a very careless observer, who does not immediately perceive the change in riding from one into the other. The water in each of these tracts is pecu-



liar; and there is a third kind called sulphur water. The inhabitants in general prefer that kind of water to which they are accustomed. If epidemics had affected those chiefly who use any particular kind, it is evident that where the division line is so marked, the effect would long since have been observed; but it is not so. The low places about swamps and mill-ponds, in every kind of land, are the theatre of epidemics; and the high and dry places are healthy.

197. It has been supposed that epidemic fevers are produced by some influence of clay lands on the atmospheric air, viz. by absorbing the oxygen gas in it. If so, these diseases ought to continue throughout the year, whereas they appear only in warm weather. If it be contended that it requires a certain temperature to enable the clay to act, the answer is, that, at that temperature, in such wet soils as these generally are, miasmata arise from the vegetable matter. There is, therefore, present, a cause known to be capable of producing these diseases; and there is no ground for believing that clay lands have a special influence, the same circumstances on any other lands producing the same effect.

198. It has been supposed that water below the surface of the earth and near to it, as in the flat country of Holland, produces epidemics. Pringle says, that, in that flat country, the water is "so near the surface that a dry ditch is seldom seen; and as the soil is light, the moisture easily transpires, and in summer loads the air with vapour, even when no water is visible. This is the condition of most of Dutch Brabant, where the people are more or less subject to in-

intermittent fevers, in proportion to the distance of this water from the surface."<sup>1</sup>

199. On the last mentioned circumstance alone, rests the belief that the subterranean water produces autumnal fevers. It should, however, be considered, that the distance of the water from the surface, is the same as the height of that surface above the marshes; these low places being on a level with what is called the subterranean water, or rather below it: and therefore, to say that the inhabitants are more or less subject to fevers in proportion to the distance of this water from the surface, is the same as saying they are more or less subject to fevers in proportion to the height of the surface above the marshes; which is perfectly consistent with the origin of autumnal epidemics in a gas derived from these low places.

200. In that country moreover, wet summers, when the moisture must be nearest to the surface of the earth, are the healthiest; and hot dry summers the most sickly. Pringle himself says, "It is remarkable that pestilential diseases have frequently occurred in dry and hot summers; and agreeably to this, I have observed that the most sickly seasons in the field have been attended with the greatest heat, and the least rain."<sup>2</sup> "The most healthful campaigns have, therefore, been those in which the heat and moisture of the air were moderated by frequent showers."<sup>3</sup> These campaigns were in Holland.

201. There is a tract of country in this state, about thirty miles east of the Blue Ridge, and lying nearly

<sup>1</sup> Pringle on Diseases of the Army, p. 2. 3.

<sup>2</sup> Ibid. p. 82.      <sup>3</sup> Ibid. p. 184.

parallel with it, in which all the three last alleged causes are united. The land is a whitish clay, retaining water near the surface, and without any good drinking water. I have traversed almost every part of this tract of country between the Potomac and Rappahannock rivers, a distance of about fifty miles by the road, in the course of the time from 1802 to 1822, and have had patients in almost every part of it. The inhabitants of this country are neither continually sick, as they should be if they were really exposed to the action of three causes of epidemic disease, combined in action and continually present; nor are they equally liable to disease in every part of the tract, as they for the same reason ought to be under these circumstances: but like those who live in the adjoining land of different qualities, without water near the surface, and with good drinking water, those who live in marshy lands suffer severely in hot weather, and those who live in more elevated situations in hot and wet summers only.

202. Moisture alone is thought by some to be capable of producing intermittents. A cold damp air no doubt may produce an intermittent; but this is the effect of the cold well known to be a remote cause of fever (139). That moisture alone is not sufficient, is evident from the fact before stated, that in the midst of the torrents of rain that pour down in the tropical regions, those persons are safe from disease who are on board of well aired clean vessels at sea; or even at anchor, if they are not near a marshy shore (145); and that in Holland the wettest seasons are the most healthy (200).

203. Dryness of the atmosphere has also been considered as a cause of epidemics. It has been alleged in support of this opinion, that the long prevalence of hot southerly winds, has at all times, and nearly in every country, been occasionally productive of epidemic disease; the mortality during an epidemic vastly increasing during a southerly wind, and on the recurrence of north winds a correspondent diminution taking place, till the disease is extinct.<sup>1</sup>

This certainly is no foundation for the opinion that dryness of the atmosphere produces epidemic disease. Winds are wet or dry in every region, according to its situation with respect to the sea: and on this account, in all the south of Europe and of Asia, the south wind is not dry, but moist.<sup>2</sup>

In every place mentioned as thus affected by the prevalence of the south wind, except one, that wind is very moist. In the country excepted, Egypt, it is a dry wind, because it blows from the interior of Africa. Here also it produces the same effect, increasing the mortality of epidemics. It is evident, therefore, that it is not by its moisture, much less by its dryness, that this wind acts so injuriously. There is another circumstance connected with it, always present in countries north of the equator, and therefore in all the countries above alluded to, which has a powerful influence in increasing the violence of epidemics. These southerly winds, whether moist or dry, are in the countries mentioned always hot; and it is the increase and

<sup>1</sup> Philadelphia Journal, &c. No. 16. p. 359.

<sup>2</sup> Protinus Æoliis Aquilonem claudit in antris  
Et quæcunque fugant inductas flamina nubes:  
Emittitque Notum. *Madidis Notus evolat alis.*

decrease of the temperature of the air that causes the effects observed, in what manner has been already shown.

204. It is an unanswerable objection to this or any other condition of the atmosphere being alone the cause of the autumnal or hot weather epidemics, that while the former is general in its operation, the latter are partial in their appearance ; being more violent in one place than another, desolating some spots, while others at a short distance escape altogether. So partial an effect cannot flow from a cause general in its operation.

Thus while in the places mentioned,<sup>1</sup> dry weather produces epidemic disease, in other places the contrary effect is observed. In the deserts of Africa and of Arabia there are no such diseases. In Senegal it is healthy in the driest time, and very sickly in the midst of incessant rains, and abounding moisture of the air. In Philadelphia the driest year known for almost a century, the year 1805,<sup>2</sup> was very healthy in comparison with the year 1793, in which it was rainy till the first of August ; or with the year 1797, in which it was rainy after that time. In this whole country, the driest years are the healthiest except in spots, and these are the wettest spots in the country.

205. This opinion is moreover utterly at variance with some well ascertained facts, viz. the prevalence of epidemics in low places, showing that the cause of these diseases is denser than the atmospheric air ; and the circumstance of this cause's taking, in consequence

<sup>1</sup> Philadelphia Journal, &c. No. 16, p. 359.

<sup>2</sup> Rush's Works, Vol. 4. p. 95.



of its density, its direction from the wind (161 to 163); whereby, its presence being ascertained by its effects, it can be traced to the spot where it originates; to the windward of which its effects cannot be observed (163).

206. A rarefied state of the atmosphere has been mentioned as a cause of epidemic disease.

A number of morbid symptoms have been experienced at the top of high mountains, which have been attributed to the rarefied state of the atmosphere in those elevated situations; and it is argued that such symptoms must be produced wherever such a state of the atmosphere exists. True; but where does it exist on the surface of the earth at the ordinary level of human habitation?

If any degree of rarefaction, actually existing on the ordinary level, were capable of producing the effects observed, elevated situations would be the most sickly, and low ones the most healthy; and the hottest seasons, and the hottest countries, would uniformly be the most sickly; all of which consequences of that hypothesis are untrue (166. 143. 144. 155). This hypothesis is also liable to the same insuperable objection with some of the preceding, that the phenomena are too partial for so general a cause (204).

207. Comets have of late years been seriously proposed as the chief cause of epidemics. The absurdity of the idea will appear at once, if we consider, 1, that comets appear in winter as well as in summer; most epidemics in hot weather: 2, comets continue to appear as in former times; but the tremendous epidemics over all Europe no longer appear since that continent has been better cultivated, drained, &c.: 3,

epidemics often occur before, often after the appearance of comets, sometimes a whole year. Now if they appear because of the approach of comets, they ought to be more and more severe the nearer they come; but these diseases are often over before they approach nearest: if it be said epidemics appear because of the going off of comets, then ought they not to appear before the nearest approach of those bodies: 4, epidemics, if produced by comets, ought to be universal in the earth, which is not the case.

208. It is evident, therefore, that there is not sufficient ground for believing that the epidemic diseases of hot weather are produced by a gas arising from putrefying animal matter (179 to 195); or by bad drinking water (196); or by the influence of clay lands (197); or by water below the surface of the earth (198 to 200); or by moisture alone (202); or by dryness of the atmosphere alone (203 to 205); or by a rarefied state of the atmosphere (206); or by comets (207); but that we have abundant reason to believe these wasting pestilences are the effects of a dense gas the product of the putrefaction of vegetable matter (141 to 178).

209. The more closely we investigate the subject, the more certainly we shall find that this doctrine rests on the strong foundation of truth. Most physicians have indeed been convinced of its general truth; yet do many of them inconsistently attribute the minute variations of epidemic diseases to some *unknown* constitution of the air. "More causes of natural things are not to be admitted than are both true and sufficient for explaining their phenomena."<sup>1</sup> An *unknown* cause

<sup>1</sup> Newton.

ought not therefore to be resorted to for explaining these variations ; particularly as it is evident that the various degrees of the power of the cause which produces an epidemic, are not only sufficient to produce minute variations, but *must* produce them.

210. The subject is worthy of the fullest investigation ; and I shall endeavour to show, by an examination of the topography of the various parts of the earth in which epidemic diseases have appeared, and of the circumstances in which they have arisen, that in every country the epidemics of hot weather are produced by the same cause, the dense gas arising from putrefying vegetable matter.

## CHAPTER IV.

THE DENSE GAS, THE PRODUCT OF THE PUTREFACTION OF VEGETABLE MATTER, THE REMOTE CAUSE OF THE EPIDEMICS OF HOT WEATHER IN THE UNITED STATES, THE WEST INDIES, AND SOUTH AMERICA.

211. THE difficulty of this investigation is greatly increased by the neglect to state the topography of the seats of epidemics, and the variations of the weather preceding and during the time of their prevalence. In the Medical Repository of New-York, in consequence of the unusual violence of the epidemics in most parts of the country, about the time of its commencement, and of the novelty of the work, many accounts of diseases in various places appeared. From that work, much of the following, relative to this country, is extracted.

212. The north, though less liable to severe epidemics, occasionally experiences them ; and they occur in those seasons, the temperature of which approaches that of more southern regions. In the hot summers from 1793 to 1799 they were particularly severe.

213. Portland is a sea-port of the state of Maine, in the neighbourhood of which there is marshy ground and one or more streams of water.<sup>1</sup> In a letter<sup>2</sup> from Dr. Barker of that town to the editors of the work

<sup>1</sup> Medical Repository, Vol. 2. p. 149.      <sup>2</sup> Ibid. Vol. 2, p. 147.

above mentioned, it is stated that in that neighbourhood an epidemic fever and dysentery, with unusually severe symptoms, commenced about the middle of August 1797, and became very general. July was very dry and sultry, and August remarkably wet and drizzly. A considerable share of the bad cases occurred near together on a low marshy piece of land.

In the following year, 1798, the summer was unusually hot and sultry. From the beginning of July to the last of February '99, an epidemic fever was very prevalent in several towns.<sup>1</sup>

In 1799 the summer season was rainy and cool, and general health prevailed.<sup>2</sup>

In 1800 the weather was unusually hot and dry. The thermometer rose to 90 degrees on several days, and the sickness began in the fore part of July. From the first of August to the middle of September, the cholera morbus was remarkably prevalent, and more malignant than it had ever been known.<sup>3</sup>

In 1801 August was for the most part cool and rainy; September dry and sultry. The first cases which Dr. Barker attended, wearing any formidable aspect, occurred in the latter part of August. In September malignant fevers occurred in different parts of the country near stagnant ponds of water.<sup>4</sup>

214. Here we see, in a neighbourhood with streams of water, marshes and ponds, an epidemic unusually severe occurring in the hot summers of 1797, 1798, and 1800; while the cool and rainy summer of 1799 was healthy: and with regard to the minute variations,

<sup>1</sup> Medical Repository, Vol. 3. p. 364.

<sup>2</sup> Ibid. p. 367.

<sup>3</sup> Ibid. Vol. 5, p. 144.

<sup>4</sup> Ibid. Vol. 6, p. 18.



in 1797 July was "very dry and sultry," "August wet and drizzly," and the disease did not commence until the middle of August: in 1798 "the summer was unusually hot and sultry," and the disease commenced in the beginning of July: in 1800 "the weather was unusually hot and dry," and the sickness began in the fore part of July: in 1801 August was for the most part cool and rainy, and the weather not dry and sultry till September; and the first bad cases occurred in the last of August, and the fever did not prevail until September.

215. The town of Hanover, in New-Hampshire, is situated on the east bank of Connecticut river. On the east it borders on a low meadow, overflowed in the rainy season. The spring of 1798 was uncommonly late and wet. The summer was ushered in at once, and was as remarkably hot and dry. About the middle of June, several days were almost insupportable, and universally spoken of by the oldest men as the hottest ever known. Under these circumstances of unusual heat in this town, heretofore remarkably healthy, a fever broke out in June, and affected many people in the following summer months.

A considerable parcel of potatoes was allowed to remain in a putrefied state, within twenty feet of one of the houses in which the first cases appeared, and less than forty from the main street. In this house were nine persons; eight took the fever, of whom seven were among the first cases: the one who escaped left town before the fever made its appearance. This circumstance contributed, no doubt, to the general effect. But that, in consequence of the unusual heat, the gas

arising from the marshy ground was the principal cause, is evinced by the fact, that a number of the neighbouring towns, in the country about the Connecticut river, on its small streams, low grounds, &c. were likewise affected.<sup>1</sup>

216. Near Charlestown, Massachusetts, there is an extensive body of marsh, at times overflowed. The account states, that being salt, it does not injure the health of the inhabitants ; but it is added, that bilious and hectic complaints are the prevailing diseases, and that scarce a year passes without the occurrence of several instances of malignant bilious fever in August, September and October.<sup>2</sup>

217. A part of the town of Sheffield, in Massachusetts, was from 1793 to 1797 the seat of epidemic disease. In 1796 particularly, almost the whole population were sick.<sup>3</sup>

That part of the township in which the sickness prevailed is almost a perfect level. The river Housatonic, whose width is generally between thirty and forty yards, runs through it in a serpentine direction, and with a very gentle current. On each side of this river is a considerable extent of luxuriant meadow ground, much interspersed with coves or pools, which are left, after the subsiding of the freshets which occasionally overflow it, full of stagnant water. There are also several other streams which run through large tracts of flat and very marshy land. On one of these streams, towards the north end of the township, is a mill-pond, the dam of which had some years before been raised

<sup>1</sup> Medical Repository, Vol 3, p. 5, by L. Spalding, M. B.

<sup>2</sup> Ibid. Vol. 2, p. 8. <sup>3</sup> Ibid. Vol. 1, p. 453, by Dr. Buel.

seven feet. In consequence of which the water overflowed "a large tract of land which was formerly covered with a luxuriant growth of timber and other vegetable productions, and which are now (1796) all dead and in a state of dissolution, in consequence of the action of the water on them. Whenever a dry season occurs, the water recedes from almost the whole of the land last flowed, and leaves the whole mass of dead animal and vegetable substances lying on its surface, exposed to the action of a scorching sun."

218. In 1796 the spring was backward and wet, and this wet weather continued till the end of June; so that the whole country was surcharged with water. From the beginning of July there was seldom any rain, and uniformly the weather was intensely hot, particularly in August. The pastures were parched almost to perfect dryness.

The epidemic commenced a little before the middle of July. Suppose a circle drawn around a point on the south-eastern side of this pond, of three miles in diameter. Without the supposed circle there were not, in that neighbourhood, ten sick families; nor were there within the circle ten free from sickness. At least half of all the inhabitants of the circle were sick in the course of the fall with bilious fever or dysentery. The eastern part of this circle, through which flows the Housatonak, was the most populous and the most sickly. Out of four hundred and fifty inhabitants, two hundred and fifty at least were sick. Of the hundred and fifty who lived nearest the pond, not ten escaped. Of one hundred and fifty who lived west of the pond, about fifty were affected.<sup>1</sup>

<sup>1</sup> Medical Repository, Vol. 1, p. 457.

219. In the south part of the town there is also a pond; but in general the sickness near it is inconsiderable. Even in 1796 there were but two or three deaths contiguous to it; but in 1794 the fever which prevailed was principally in the immediate neighbourhood of the south pond. On inquiring into the cause of this general exemption of those who lived near the south pond, and of their particular suffering in 1794, it was ascertained that the land overflowed by the south pond is much more constantly and completely covered with water, than that overflowed by the north pond: and that in the year 1794, the water of the former was drained off for the purpose of making repairs, thereby leaving the bottom of the pond exposed to the action of the sun.<sup>1</sup>

220. The inhabitants of the flat country in the neighbourhood of Detroit, on which there is much stagnant water, are affected with bilious complaints every fall.<sup>2</sup>

221. In 1796 an epidemic fever excited considerable alarm in Boston. July and August of that year were intensely hot. The disease appeared on the 25th of August. "A very great proportion of the sick were near extensive flats, particularly about the easterly, southerly, and westerly skirts of the town. The place called Oliver's dock, where this disease was most prevalent, was exposed to exhalations from foul substances lodged about the wharves and docks of that quarter, with buildings so constructed as to admit of very imperfect ventilation, and with large numbers of inhabitants crowded together in a small

<sup>1</sup> Medical Repository, Vol. 1, p. 458, note.

<sup>2</sup> Ibid. p. 526.

space.”<sup>1</sup> As the cool weather advanced, the mortality was greatly diminished. Dr. Warren, from whose account of the fever this is taken, had almost every fall seen a considerable number of cases similar to those of 1796, not excepting the black vomit, yellow skin, &c.<sup>2</sup>

222. The yellow fever prevailed in Boston in 1798 also. The months of July, August, and part of September, were hot and sultry.<sup>3</sup> The weather was never known to be so uniformly and excessively hot.<sup>4</sup> The fever commenced on Stoddard’s wharf, situated between Mill-creek and Town-dock. The dock is the receptacle of a large sewer, into which, in consequence of its being in the vicinity of Faneuil Hall market, all the offal of the market is thrown.<sup>5</sup> “The market-place is a low sunken part of the town. It is, from situation, the reservoir of every putrid matter flowing in from more elevated parts of the town, and accumulated by every rain. It is surrounded by docks of stagnant water, filled with offal, and all manner of noxious matters.”<sup>6</sup>

223. The disease also appeared at the latter end of July, at the foot, and on the declivity of the south-east and south sides of Fort Hill, and made a fatal progress. Scarce any family that resided below the summit, on these sides of the hill, escaped the fever. One lost five persons out of six. The south-east, south, and south-west winds prevailed most of the time of the sickness, which wafted upon the inhabitants of those sides of the hill the exhalations from the

<sup>1</sup> Medical Repository, Vol. 1, 139.

<sup>2</sup> Ibid. Vol. 1, p. 140.

<sup>3</sup> Ib. Vol. 2, p. 467, by Dr. Rand.

<sup>4</sup> Ib. p. 392, by S. Brown, M. D.

<sup>5</sup> Ibid. p. 467.

<sup>6</sup> Ibid. p. 390.



wharves, stores, and docks, at the foot of it, and from the extensive flats in the skirts of those quarters of the town (221).

224. In the last of September the wind shifted to the west and west-north-west, which conveyed the noxious exhalations from the mill-pond into Back-street. The inhabitants contiguous to the pond, and others, throw every kind of filth into it (154), and the filth of the streets flows into it in every direction. This pond was often drained of its water, so as to leave the mud and putrid substances exposed to the action of the sun. When the fever appeared in this street, the selectmen were requested to order the water to be retained constantly in the pond; which being done, the fever soon ceased in that quarter.<sup>1</sup>

225. This fever has been attributed chiefly to a great quantity of putrid beef and fish, and raw hides, then stored at the margin of the river, on the south-east and south sides of Fort Hill (223). It is to be observed, however, that similar fevers prevail in hot summers where there are no such collections of animal matter (191); that, in this town, similar cases occurred in 1796 and frequently before (221), when there was no such cause alleged; the abundance of beef and fish in the town in 1798 having arisen from its being detained through fear of the French cruizers which were then committing great depredations on our vessels;<sup>1</sup> that in the skirts of those quarters of the town there were extensive flats sufficient to produce the disease, and to them the fever in 1796 appears to have been at the time attributed;<sup>2</sup> and that the cases

<sup>1</sup> Medical Repository, Vol. 1, p. 470.

<sup>2</sup> Ibid. p. 137.

which occurred in other parts of the town in 1798 were clearly to be attributed to a similar cause (224). There does not appear, therefore, any ground for attributing the fever of 1798 to exhalations from animal matter (179 to 195).

226. New-York has been repeatedly afflicted by epidemic fevers. The yellow fever prevailed there in 1795. Near where it began, there were several unfinished docks, which had been receptacles for several years of every kind of filth and dirt. By raising one of the streets, the proper drain from some of the grounds in the neighbourhood was prevented. The bilious fever had prevailed in that quarter for several years successively. In 1795 it spread more generally through the city, in which year there was an extraordinary prevalence of heat and moisture in the air. In 1796 this part of the city was more healthy, and the fever appeared in a part "hitherto reputed little liable to particular sickness."<sup>1</sup>

In investigating the causes of this change, a recourse to facts will afford a sufficient explanation. 1st. The docks spoken of in the south-eastern part of the city, which were in so loathsome a state, and which were so sickly, had been completed and generally covered with a sufficient quantity of good earth, gravel, or sand; the grounds drained, or rendered uniform with clean earth; and the wharves kept free from rubbish and filth. 2d. At the south-western part of the town, between White Hall and Exchange slips, which having been healthy, had in 1796 become sickly, a new dock was made between July 1795, and

<sup>1</sup> Medical Repository, Vol. 1, p. 127. 128. 130, by Dr. Bailey.

July 1796. As early as the month of April 1796, the stench which issued from this dock was highly offensive. On inquiry, Dr. Bailey found that the new ground was made chiefly of the dirt which had been accumulating in the streets during the winter; "of every thing subject to decay and corruption." About the middle of June the offensive smell from the new dock, &c. was very generally observed in that quarter of the city; and many complained of sick stomach and head-ach. The slips in the neighbourhood were also offensive, and had been so during the fever of 1795. In the latter part of June, the fever began to show itself about White Hall and the Exchange; but high winds, heavy rains, and much thunder and lightning and cool weather, occurred about the middle of July, and the disease was suspended. As soon as the weather became warm again, the fever returned.<sup>1</sup>

227. It appears further,<sup>2</sup> according to the health office records, that the yellow fever broke out in 1796 at White Hall; at the foot of Pine street, (then a very dirty place near the water); at Burling slip; and in the neighbourhood of Roosevelt sewer; and in 1797, between Coenties slip and the Old slip, in Front-street; at the Fly market in Fletcher-street; at Burling slip in Water-street; and near Roosevelt sewer in George-street. A large part of the bottoms of some of these slips is exposed at low water to the action of the sun, and they send forth effluvia sensibly contaminating the air.

228. In 1798 the disease first appeared between Coenties and the Old slip in Front-street, between

<sup>1</sup> Medical Repository, Vol. 1, p. 129.    <sup>2</sup> Ibid. Vol. 2, p. 303.

the first and seventh of August. On the last mentioned day, twenty-three cases were reported; soon after which, the offensive lots were covered with "clean wholesome earth," and by the 26th, the disease had disappeared in that quarter. The fever appeared on the same day in several different parts of the city near the slips, sewers, or where the lots were low, in consequence of raising the streets. On the 14th of August, in the morning, a very heavy rain fell without intermission from five till nine o'clock. A great number of cellars were filled, particularly in the low parts of the city. Lispenard's meadow, which may be considered as within the limits of the city, was entirely overflowed, and the water did not pass off until a large drain was opened by order of the common council. After this rain, the mercury in the thermometer raised from 78 degrees, in three or four days, to 90 degrees.

229. From this period the disease became more general. Its violence was principally felt in Cliff-street and its neighbourhood, in Water-street, and on the unfinished grounds in the southern part of the city.

The situation of Cliff-street, with respect to Burling slip sewer, is such, that the southerly and south-easterly winds force a current of air throughout the sewer, carrying with it the exhalations arising from the noxious matters collected there, and driving them up Golden hill and into Cliff-street. On the 20th of August, the wind which had been at north-west, shifted round to the south-east, and continued to blow from that quarter for some time. In forty-eight hours after it began, there was scarcely a house in Pearl-street,

in the lower part of John-street, and in Cliff-street, which did not contain sick persons.<sup>1</sup>

230. The effect of high temperature, where moisture and filth abound, is strongly shown by the following statement.

The greatest height of the mercury in the thermometer was, in July, - - - in August, - - -	} in 1795	in 1796	in 1797	in 1798
- - -	83°	88°	90°	94°
- - -	93°	89°	82°	96°

The hottest year, 1798, was the most sickly; two thousand and eighty-six died. The year 1795, which in one month approached the temperature of that year, was next in sickliness. The evil was increased in 1798 by the very heavy rain in the middle of August, followed by a considerable increase of the temperature already high (228). "In 1795 the weather was warm and moist, but there was but very little rain. In 1798 the weather was not only much warmer, but was accompanied with sudden and heavy rains."<sup>2</sup>

231. At the south end of Seneca Lake, in New-York, there is a valley six miles long and one wide, lying in the same direction with the lake. Three miles of this valley are, during the months of April and May, for the most part covered with water, in consequence of the lake being at its greatest height. As the waters of the lake subside, the very rich soil is left covered with aquatic plants and animals. At this spot, I. W. Watkins, who gives the account,<sup>3</sup> formed a settlement in 1795 with about twenty men. "As the heat of the season increased, they successively grew sick." During the season the same fever was very prevalent over that region, particularly in the

<sup>1</sup> Medical Repository, Vol. 2, p. 307.

<sup>2</sup> Ibid. p. 308.

<sup>3</sup> Ibid. Vol. 3, p. 359.



neighbourhood of ponds and marshy grounds. It was called Lake fever, and produced an universal yellowness over the body. It has been less prevalent since that year, which was remarkably warm and sultry.

232. "Between the years 1792 and 1796, a gentleman began to erect a furnace and forge in the mountains, a few miles above Haverstraw, for which purpose he erected a dam across a large stream of water, and overflowed a large tract of land: he built small houses around it for his labourers, and was carrying on his work with vigour until autumn, when the heat of the weather dried his pond, and soon after his labourers were generally attacked with a very malignant fever, which was so mortal that most of them died; the remaining few fled, and since that time the work has been neglected on that account."<sup>1</sup>

233. "In the year 1797 several mills were erected in the town of Greenfield, and county of Saratoga, during the winter and spring, that caused much land to be overflowed with water, which in summer became dry. The ensuing autumn most of the inhabitants were attacked with a fever" which "proved very malignant." "It was attended with the same symptoms that characterize the present yellow or malignant fever in the city of New-York, except that many who died of it did not vomit; and of those who did some vomited black, and others did not. The succeeding years the new ponds were emptied every May, and not filled until fall, and these malignant fevers visited them no more."<sup>1</sup>

234. In the neighbourhood of the medicinal spring

<sup>1</sup> Medical Repository, Vol. 10, p. 240, by Dr. J. G. Scott.

called the Rock Spring, in Saratoga county, New-York, is a vast quantity of low, flat, moist land; the spring is in a valley, the bottom of which is a swamp, through which slowly flows a considerable stream. The surrounding inhabitants are visited every season with a fever, that proves very mortal.

235. "In the year 1804, a gentleman from New-York, improving a plantation up the North river as high as West-Point, on the east side, in the neighbourhood of some newly-erected mills, was under the necessity of discontinuing his work on account of a highly malignant fever that originated and prevailed in that place. And I can substantiate by as good medical authority as this city (New-York) can afford, that at least one of his people died of the same disease as the yellow fever of New-York."<sup>1</sup>

236. On the Kaydeross creek, which flows easterly through the county of Saratoga, in New-York, are a number of mills, the ponds of which cover a great deal of the adjacent land. The vegetation on each side of the creek is very luxuriant. Soon after the erection of the dams belonging to these mills, very mortal fevers made their appearance. "It was not uncommon to see families consisting of ten persons, lose three or four of their members in the course of one warm season." The owners of the mills were with some difficulty induced "to open the dams and draw off the water during the sickly months. The consequence was a restoration of health to the inhabitants;" and, "although intermitting and remitting fevers do still prevail, they are not marked with their former malignity."<sup>2</sup>

<sup>1</sup> Medical Repository, Vol. 10, p. 241.    <sup>2</sup> Ibid. Vol. 12, p. 131.

237. "The village of Waterford is situated at the confluence of the Hudson and Mohawk rivers, on a flat which terminates about 150 rods west of the Hudson, in a rise of ground that runs parallel with that river to the north." This village "has generally been remarkable for its salubrity. In the summer of 1805, a small quantity of water had been suffered to collect and stagnate in the centre of the village; an accumulation of filth of various kinds had prevented it from being drained as usual from the ground." Early in September, persons occupied near this pond were attacked by violent fevers. "There was scarcely a person who was in the habit of frequenting the vicinity of this pond, but was in some degree affected by its exhalations. About twenty persons were violently seized with fevers similar to the above, all of which could be traced to this source."

There had also been erected, in the summer of 1804, a mill-dam across the branch of the Mohawk adjoining the village. This dam set the water back into a creek, which in the summer had always been dry. The trees, &c. during the summer of 1805, protected this pond from the sun. In the winter of 1805, the trees were cut down for fire wood. In the summer of 1806, the sun had free access to the pond, and of about fifty persons residing near the bank of this creek or pond, not one escaped an attack of bilious remitting or typhus fever, and most of them were sick during the whole season. Many of those further off were also affected, but not so severely; and they recovered more easily and more perfectly.<sup>1</sup>

<sup>1</sup> Medical Repository, Vol. 12, p. 132, by Dr. Stearns.

238. In Orange county, New-York, there is a tract of land near the Wallkill, lying lower than the outlet of the river, and therefore subject to inundations, and almost always wet and marshy. There are many thousand acres of rich land thus situated. The country adjoining has been famous for its unhealthiness ever since it was settled. A company undertook to drain this land, but few constitutions were found capable of long enduring the malignity of its atmosphere, and very few withstood it many weeks. "The temptation of liberal pay draws to this unwholesome region a crowd of hardy labourers." Some of the most sturdy are overpowered in a few days ; and almost all in a few weeks.<sup>1</sup>

239. Bald Eagle valley, in Pennsylvania, is low and generally flat. Near to Bald Eagle creek, which runs through the valley, are many ponds of stagnant water. From the settlement of the valley, the ponds continued full, and the inhabitants healthy, until 1797. The trees had been gradually cleared away ; the ponds became filled with trees, rubbish, and putrid substances ; and being exposed to the rays of the sun, were nearly dried up towards the end of that summer, and sent out a very unpleasant smell. The consequence was, in the hot years 1797, '98, and '99, a fever which killed often in forty-eight hours, and had every symptom mentioned in the accounts of the yellow fever in Philadelphia and New-York. In the year 1797 it was as fatal in Milesborough, on Bald Eagle creek, according to the number of inhabitants, as it was in Philadelphia in 1793. A large pond of water stood near

<sup>1</sup> Medical Repository, Vol. 14, p. 11, by Dr. Cole.

the town. The water formerly shaded by the trees, was now exposed to the sun, and the season being very dry and warm, was in a great measure dried up. The pond abounded with putrefying vegetables, and the stench was great; few in the town escaped sickness of the most malignant kind, which continued through August and September. The pond has since been drained off, and the inhabitants are as healthy as usual.

The year 1799 was very dry. The mercury in the thermometer stood often as high as 95 degrees, and one day in the shade as high as 99 degrees. This season the symptoms were much the same as in the two preceding, only more violent. "The black vomiting was characteristic."<sup>1</sup>

240. In the rich state of Ohio there is a great number of streams, on the borders of many of which are those extensive plains called prairies. They extend from the bank of the stream to a second bank at various distances from the first; and the ground is often lower at the foot of the second bank than it is near the stream, in consequence of which the water stagnates in the plain.

These plains are covered with a luxuriant growth of grass and weeds, which in the autumn and winter fall, and in the heat of the ensuing summer rot so completely, that the leaves which fall or are blown into low places, often entirely disappear before the next fall of the leaf. The air of this country is very moist.

Fevers prevail almost exclusively in the low tracts of country, and for the most part along the streams.<sup>2</sup>

<sup>1</sup> Medical Repository, Vol. 4, p. 105, by Dr. Harris.

<sup>2</sup> Ibid. Vol. 10, p. 6, by Dr. P. Harrison.



241. In 1800 the summer was unusually dry until about the middle of August, and the waters unusually low. During this time it was tolerably healthy at Chilicothe, on the Scioto, and in the neighbouring country. About the middle of August it rained so as to raise the streams over their banks. Shortly after, a fever prevailed in Chilicothe, and in the settlements on the Scioto and its tributary streams, which abated in October.<sup>1</sup>

242. The spring of 1801 was very wet; the rains were frequent and violent until the first of June. From that time until the latter part of August it was dry, and intensely warm. There were seasonable rains in September and October, and the heat was as intense in September as in any of the summer months.

The fever began early in July on Deer creek, and soon after on the Kinnakenic, and the Blackwater, and on the Pickaway plains; and finally reached the high banks and Chilicothe.<sup>1</sup>

243. In the spring and summer of 1807, there were three freshets in the Ohio river; the low lands were covered with water, and many crops of corn and grass were destroyed by it. In every direction there was a profusion of vegetable matter in a moist state. In June ophthalmia was very common: by the middle of July intermittent and remittent fevers were common; and in August the fever was general all along the river for several hundred miles.<sup>2</sup>

244. Marietta is situated on the rich bottoms of the Ohio river; and the Muskingum river flows through

<sup>1</sup> Medical Repository, Vol. 10, p. 6.

<sup>2</sup> Ibid. Vol. 11, p. 345, by Dr. S. P. Hildreth.

it. The Ohio river was in the summer and autumn of 1822 lower than it was ever before known to be. The water was in most places nearly stagnant, resembling a long lake. The shores were lined for several rods in width with aquatic plants and grass, as early as the month of June, although in common seasons they are not seen sooner than August or September. A disagreeable smell arose from these putrefying materials along the shore of the river, which was perceived by every one in the morning and evening, and at all times of the day by those inhabitants of the high grounds who approached the river.<sup>1</sup>

The fever in that summer was confined to the neighbourhood of streams, the bottoms of which, thus laid bare, exposed to the action of the sun a great mass of vegetable matter, while the upland, destitute of moisture, continued healthy. Those settlements, also, in which the shores were bold and there was no wide beach to the river, were healthy.<sup>2</sup>

245. In the year 1823 the whole country was deluged with rain in the months of June and July. The rains ceased the last of August, and the weather was dry for the remainder of the season. The weeds grew to the height of fifteen or eighteen feet; many fields of corn were entirely destroyed by the wet, and many fields of wheat lost after having been reaped.

The epidemic of this year was not, as in 1822, confined to the vicinity of water courses, but infested the uplands as well as the valleys. Even some districts in the Alleghany mountains were visited with inter-

<sup>1</sup> Phil. Journal, &c. No. 17, p. 107, by S. P. Hildreth, M. D.

<sup>2</sup> Ibid. p. 106.

mittent and remittent fevers. The only part of the state, east of the Scioto river, that remained healthy, was a district of country embracing New Connecticut, and extending in that direction from Lake Erie to the Ohio river; *where it was very dry*, and the inhabitants entirely escaped fevers.<sup>1</sup> The disease continued to rage through the month of October, and was only suppressed by the heavy frosts in the beginning of November.<sup>2</sup>

246. New Design, a village about fifteen miles from the Mississippi, stands on high ground, but is surrounded by ponds. In 1797 the yellow fever carried off fifty-seven out of two hundred inhabitants. Dr. Watkins, who gives the account, had seen the yellow fever in Philadelphia.<sup>3</sup>

247. Louisville, in Kentucky, stands on an elevated bank of the Ohio river, but on very flat land exceedingly rich. The neighbouring country is also rich and level; particularly a low flat district of land called Pond settlement, which commences in the town itself, stretches in a south-west direction about twenty miles, and is six or eight miles wide. On this tract of land are numerous ponds and marshes, and it is clothed with the most luxuriant vegetation.

The annual rise of the Ohio river in the winter and spring, usually of about twenty-five feet at Louisville, brings down a great deal of vegetable matter, which, when the water subsides in May or June to the low water mark of summer, is left, on the surface lately inundated, exposed to the action of the sun.

<sup>1</sup> Philadelphia Journal, &c. No. 17. p. 112.

<sup>2</sup> Ibid. p. 115.

<sup>3</sup> Medical Repository, Vol. 4, p. 74.

There is a small stream which empties into the river immediately at the town, where there are some wharves and the chief landing place for boats. The bottom and banks of this creek, after the subsidence of the water in June, are generally very foul and muddy. On this creek about a mile from the town is a mill and a pond. In the town there were, in 1821 and 1822, at least eight ponds.

248. The summer and fall of 1819 and 1820 were remarkably dry; little rain had fallen in the spring and early summer months; the ponds in and near the town were dried up before the first of July in each year. Even in the pond district of country there was little or no stagnant water. The river was low in both years. Both of these very dry years were remarkably healthy.

249. During the spring and summer of 1821 there was an immense quantity of rain: the ponds were all overflowed, and the earth thoroughly saturated with water. The summer was warm, and the winds were from the south-west, sweeping over the pond district.

This district is thinly settled, but suffered severely in this year; and the town also, especially the skirts of it. Those who lived in the suburbs nearest the ponds suffered earlier, and more severely than those who inhabited the central part of the town.

250. In the spring of 1822 there was "an almost unprecedented quantity of rain, and during June, July, August, and September, an unusual succession of heavy and continued showers. The rain, though it fell in excessive abundance and in heavy torrents, seemed to have no effect in cooling the atmosphere. There was a closeness and sultriness of atmosphere

proving very oppressive during the summer months, which with little or no abatement continued through the night as well as day."

The fever commenced earlier in this year than in 1821, and was more severe and unmanageable. The pond district suffered first, and afterwards the town; the south-west part being first affected.<sup>1</sup>

251. The eastern end of the state of Tennessee is a rough mountainous country, and is extremely healthy; intermittent and remittent fevers being rare, except on the large rivers. Part of the western end of the state adjacent to Kentucky, is equally broken, and enjoys an atmosphere not less salubrious.

The south-west of the state is level and fertile. Dispersed over the country are numerous ponds, especially near the mountains. From the flatness of the surface, the waters run off slowly, and in some places stagnate. In the heat of summer, fevers, intermittent and remittent, sometimes of a very aggravated form, prevail.<sup>2</sup>

252. Natchez is situated on the east bank of the Mississippi, in north latitude 33 degrees 31 minutes, from one hundred and fifty to two hundred feet above the surface of the river at low water. The shore forms a high precipice, which excludes the view of the river. The surface is very undulating, with a gradual but irregular declivity for about three miles eastward to St. Catharine's creek. "It is sufficiently remote from any swamp on the same side of the river not to be affected by its exhalations. The soil is a

<sup>1</sup> Philadelphia Journal, &c. No. 15, p. 1, by J. P. Harrison, M. D.

<sup>2</sup> Ibid. No. 3, p. 50, by Wm. Lea, M. D.



rich black mould. Bilious fever was common in the summer and fall, of which occasionally there were a few cases of the highest grade, but previously to the year 1817, the inhabitants were not afflicted with an epidemic fever."

253. After the termination of the last war, there was a rapid increase of population. Many improvements were made, buildings erected, and arrangements made and partially executed, to reduce to a convenient level the irregular surface of the site of the town. By this means ponds were formed in many parts of the town, and the natural course of the water being stopped, cellars in the low places were often partly filled; the back yards of many houses also, being thrown below the level of the street, were often wet and became the receptacle of much filth of every kind.

254. The year after the peace, 1816, was very dry and healthy. The next year, 1817, was wet and sickly. The year 1818 dry and healthy. The year 1819 wetter and more sickly than 1817. The following table, taken from the one given by Dr. Perlee, will place the whole in a clear light at one glance. The rain is stated in 225th parts of an inch.

Rain from the 1st of May till the last of August, four months.		Mean temperature, June to September, four months.	Deaths.
1816	1961	79 $\frac{1}{4}$ °	no epidemic.
1817	3285	77°	about 300.
1818	1919	76 $\frac{3}{4}$ °	no epidemic.
1819	5862	77 $\frac{1}{4}$ °	{ number not mentioned ; but stated to be the most sickly year ever known.

Of the rain which fell in the four months of 1819, very near four-fifths fell in July and August, and filled most of the cellars, and all the low places of the town. At the subsidence of the flood, hundreds of acres along St. Catharine's creek, were covered with sediment

from a few inches to several feet in depth, which afterwards becoming dry and cracking open, the putrefying substances underneath emitted most offensive exhalations. Great sickness and mortality occurred all along the course of this creek. The epidemic destroyed horses, cows, dogs, poultry, and the deer of the forest.

Of the fever in 1817 it is observed, "on the 9th of November there occurred a severe frost, which at once arrested its progress;" of that in 1819, "it continued to prevail with little variation in violence till the middle of November, when the weather becoming cooler, it began to subside."<sup>1</sup>

255. This town also experienced a severe epidemic in the year 1823, which was generally attributed to the regulation of the streets (253). "Natchez, formerly both dry and healthful, has become of late little better than a cluster of marshes." "The increase of mortality has kept pace with the progress of street improvement."<sup>2</sup> "The months of April, May, and June, were remarkable for being uncommonly wet and rainy. By the frequent and heavy showers, that fell during this period, the country was completely deluged, and the earth every where saturated with water. About the first of July, the weather became suddenly very dry and warm, and the streets of the city were soon filled with dust, the thermometer ranging from eighty to ninety-three degrees. This weather continued with little variation until the 25th of August."<sup>3</sup>

256. Occasional cases of remittent and intermittent

<sup>1</sup> Phil. Journal, &c. No. 5, p. 1, by A. Perlee, M. D.

<sup>2</sup> Ibid. No. 18, p. 241, by A. P. Merrill, M. D.    <sup>3</sup> Ibid. p. 235.

fever occurred very early. In July they “increased very much, both in number and violence.” In the first week of August they were “more numerous in the city, and were more violent than usual at that season.” “On the 12th and 13th of August, three cases of bilious remittent fever terminated fatally; one after four days’ illness, and all with malignant symptoms.” This produced some uneasiness among the inhabitants, but the board of health declared it to be their opinion that there was “*no cause for alarm.*” On the 16th two other deaths occurred, and the disease was reported by the physicians attending as *malignant fever*. On the 19th another case terminated fatally, accompanied with *black vomit*. The board still “expressed no apprehension of existing danger.” On the 19th and 20th, however, there were, it was supposed, more than fifty persons attacked; and on the 20th two persons died with the black vomit; which induced the board on the 21st to recommend a general removal, and more than two-thirds of the inhabitants, it was supposed, left the city on that day and the next.<sup>1</sup> Seventeen persons died on the 25th of the month.<sup>2</sup>

257. On the 13th and 14th of September there was a violent storm of wind and rain from the north-east. On the 15th it became fair, with the thermometer at 66 degrees. During these three days many of the sick died; but afterwards the disease became more mild and tractable, and the attacks less frequent. During the month of October it was much less malignant, and

<sup>1</sup> Philadelphia Journal, &c. No. 18, p. 241. 242.

<sup>2</sup> Medical Recorder, No. 33, p. 8.

frequently assumed the form of an intermittent. On the 31st of October, "the wind suddenly changed from south to north-west, and the thermometer fell from 78 to 28 degrees in about sixteen hours." The people flocked in immediately, but "no case of the disease occurred afterwards."<sup>1</sup>

258. This fever has been attributed to exhalations from putrid animal matter, present in and about that part of the town first affected by the fever. On the margin of the bluff (252) at the southern extremity of the city, there is a hollow place, near a third of an acre in extent, ten or fifteen feet deep next the river, and diminishing in depth gradually towards the city. "This, for several years previous to 1824, was the grand reservoir of all the filth, and the depository of all the dead animals of the city and suburbs."

259. "In the spring and summer of 1823 it contained numerous carcasses, and other kinds of filth, which attracted large flocks of carrion crows, and which they were unable to destroy as fast as it was supplied, until the appearance of the fever put a stop to further deposits."

A house in the south-eastern part of the city contained a considerable part of a boat load of bacon, pickled pork, and fish, nearly all of which, in the month of July, was in a state of putrefaction. Some of the bacon and pork was hung up in the lower room of the house and in the back yard, and still continued to putrefy. The floor of the house and the yard were covered with fœtid brine. "These putrid provisions were not removed until the yellow fever appeared."

<sup>1</sup> Philadelphia Journal, &c. No. 18, p. 255.

In the south-western part of the city "there was a large pile of putrescent oysters, which were not removed until the epidemic broke out." The fever commenced in that quarter of the town in which these putrid animal matters were lying; and to exhalations from them Dr. Cartwright attributes the fever.<sup>1</sup>

260. The cases already stated (179 to 195), particularly that in which one thousand barrels of putrid beef were removed without producing any fever in the house, or neighbourhood (192), are so strongly opposed to this doctrine, that nothing but a clear case, in which it can be shown that no other cause was present, can afford sufficient ground for believing, that exhalations from putrid animal matter are capable of producing epidemic fever. That this case does not afford that evidence, appears from the following considerations.

261. (1). The hollow place at the southern extremity of the town was, for *several years* previous to 1824, the grand reservoir of the dead animals of the city (258); but there was no epidemic between 1819 and 1823.

(2). At the landing below the bluff there is a crowded population,<sup>2</sup> and an immense accumulation of putrefying animal substances *every year*, in consequence of the great importation of pork, beef, &c. every spring from the upper country. "The quantity of putrid exhalations from this source, during the hot season, is so great, as to render an exposure to them almost insufferable to one unaccustomed to it; and

<sup>1</sup> Medical Recorder, No. 33, p. 5. 6, by S. A. Cartwright, M. D.

<sup>2</sup> Philadelphia Journal, &c. No. 18, p. 239.



yet, so far from these having ever produced a deleterious effect, it is well known that the portion of the population of the city residing near the landing, has always been exempted from the epidemics which have occurred here, until after they have raged for two or three weeks in every other part of the city."

(3). These offensive substances were present early in the season. There were numerous carcasses in the hollow place in the spring of the year, and the bacon was in the height of putrefaction in July (259): the fever therefore, if this putrid animal matter were the cause, should have appeared earlier than it did.

(4). These offensive matters were all removed as soon as the yellow fever made its appearance (259). The putrid meat, fish, and oysters, were immediately afterwards carried away; and, as on the commencement of the fever no carcasses were carried out, the flocks of crows must soon have consumed the whole. This is confirmed by the statement, that, during the prevalence of the fever, on a visit to this spot it was found "white with bones," and the stench nearly gone. It is indeed stated, that, on another visit after a rain, the stench had again become almost intolerable: but if such a stench as is experienced at the spot where carcasses have been left, and where nothing remains but the whitened bones, can produce such an epidemic, these diseases must have occurred in many instances, in which, within the knowledge of almost every person, they did not.

When the putrid animal matter, and the exhalations from it, were most abundant, the disease commenced; it continued moderate for a fortnight after

the animal matter was removed; and suddenly increased when there was no such collection in the town, at the very time when the same disease becomes general in other places, in which there are no such collections of animal matter, but which are in other respects similarly situated (255).

The sudden increase was in the third week after, when in one day, the 25th of August, as many persons died as had died in the whole preceding fortnight.<sup>1</sup> The disease continued, moreover, to increase until the middle of September, and then gradually declined until the first of November, corresponding precisely with the increase and decrease of the temperature of the season, which continued to act on that matter which continued to be present (255), not on that which had been long removed (261, 4).

(5). The sphere of its influence must certainly have lessened as the cause was removed; and when nothing remained but the fœtor of the fluids still adhering to the surface of the earth, and to the houses, the disease should certainly not have extended to distant parts of the town, not affected when this alleged cause was in all its force; much less should it have extended a mile from the town; whereas “ultimately few families within a mile entirely escaped.”<sup>2</sup>

262. On the other hand, every circumstance connected with the rise, progress, extent, and decline of this fever, corresponds with the doctrine of the origin of epidemics in exhalations from vegetable matter in a state of putrefaction.

(1). The country is exceedingly rich, and abounds

<sup>1</sup> Medical Recorder, No. 33, p. 7. 8.      <sup>2</sup> Ibid. p. 9.

with vegetation, particularly in so wet a spring and summer as that was. The summer was very hot. These circumstances are known to produce such a fever in a rich hilly country, when no such accumulations of animal matter are to be found. In this very summer such a disease prevailed in the hilly country of the state of Ohio, and even among the Alleghany mountains (245).

(2). The hollow place near the bluff contained all manner of filth (258), and was not the depository of animal matter alone.

(3). The country immediately around the town is interspersed with deep ravines or bayous. These are of various sizes and depths. The two principal ones are on the east and west of the town and very near it, the latter being on its very edge. They are seldom less than ten feet deep and ten wide, and in many places they are fifty yards wide, and as many feet deep. The sides are abrupt and continually falling in.<sup>1</sup> In that rich country it is evident that such ravines must abound in vegetation. It is stated that these two drain almost the whole town, and are, therefore, equivalent to sewers in the seaports, abounding with all kinds of offal (229). It is also evident that there must be in such ravines, irregular in breadth and depth, standing water in many places in wet summers, such as 1817, 1819, and 1823. It was observed by an old practitioner of Natchez, Dr. Seip, that "a bayou (or ravine) was more sickly than a marsh." The wind, when there was any, blew from the west and south-west; and when from the latter it passed immediately over

<sup>1</sup> Medical Recorder, No. 34, p. 245.

a country of thirty or forty miles in extent, recently inundated, and from either it passed over the western ravine, and necessarily blew whatever effluvia there were immediately on that part of the town which suffered most. The same effect on the windward side of a town has often been observed (224. 249. 250).

(4). Such regulation of streets, as is admitted on all hands to have been made in this town, cannot fail to produce wet places, more or less deep according to circumstances, as has been observed in very many instances (226).

(5). It appears from the account of the yellow fever in 1825, that there was in this quarter of the town a hollow way drained by a bayou or ravine, which “meanders for some distance along the eastern side of the new street.”<sup>1</sup> This fever appeared late, and was almost entirely confined to three spots, of which this was one. Another was in the northern part of the town, and in 1823 was well drained by a ditch forty feet deep cut through a hill, but in 1825, in consequence of the banks of the ditch having fallen in in some places, the water was prevented from passing off freely. The third was on the bank of the bayou, or ravine, just without the town, where a road was made over it by filling it up with earth, a wooden trunk having been left to carry the water off, which was crushed in and did not answer the purpose.

(6). The prevalence of the fever in the immediate neighbourhood, “within a mile of town,” so entirely at variance with the doctrine of the dependance of the epidemic on exhalations from putrid animal matter

<sup>1</sup> Medical Recorder, No. 34, p. 247, by S. A. Cartwright, M. D.

(261, 5), is perfectly consistent with the doctrine of its dependance on exhalations from putrefying vegetable matter.

The ravine from the east, and that from the west side of Natchez, gradually approach one another, and about a mile east or south-east of the town unite, and pass off to St. Catharine's creek. A short distance above the junction, a third ravine from the south unites with the western ravine, and at the junction there is "a chasm more than fifty yards wide, and from thirty to sixty feet deep." This chasm "contains in its bottom the putrid sediment mixed with the corrupted water from the western half of Natchez, and from the butcheries."

Near the eastern ravine, not far from its junction with the western, is a flat surface of about an acre, surrounded by high ground. A smaller ravine, which passes along between the two principal ones, conducts the water of an adjacent field upon this flat surface, over which it spreads before it falls into the large ravine.

On the point of land formed by the approach of the eastern and western ravines, within an hundred yards of the chasm above described, which from the account must be to the south-west, and within ten steps of the marshy spot above mentioned, are situated two taverns.<sup>1</sup>

263. In these circumstances (262), the dense gas produced by the putrefaction of vegetable matter must have abounded, and more and more as the season advanced, as long as it continued hot ; and must have de-

<sup>1</sup> Medical Recorder, No. 34, p. 244.



clined with the declining heat of the season. If then we compare the progress of the disease, and its decline (256. 257), with the progress and decline of this agent, we shall find them precisely to correspond, as they did in other places where exhalations from vegetable matter abounded, and where there were no such collections of putrid animal matter.

264. The same circumstances of abounding moisture, vegetable matter, and heat, existed in Natchez, and in many other places all along the Ohio river: in the former also there were collections of putrid animal matter. The disease commenced in all these different places about the same time, and advanced as the season advanced. The putrid animal matter in Natchez being suspected of causing the disease, was removed; but the disease, not the least affected by the removal, advanced here as well as every where else along the Ohio, as long as the cause which abounded in all the places continued to be produced, and ceased only when it ceased.

265. The fever prevailed again at Natchez in 1825, but was much more moderate than in 1823. The year 1823 was uncommonly wet and rainy until the first of July, when it suddenly became very dry and warm, the thermometer ranging from 80 to 93 degrees (255). In 1825 also there were frequent rains before July; but there were in that month twelve rainy days, in August eleven, and four in the first half of September. The temperature also was less in 1825, the mean heat for July ranging from 76 to 86 degrees, and that for August from 76 to 91 degrees.

266. In the former year there was the utmost abun-

dance of moisture until the first of July, and after that it was very hot and dry ; in the latter less rain, and that more distributed through the different months, with temperature more moderate.

In the former year, accordingly, there was a terrible epidemic ; all the circumstances perfectly favouring such an occurrence : in the latter a general bilious fever, and severe yellow fever in some particularly favourable spots, occurring not until about the first of October, when the heat was excessive, and there had been no rain, except one day, for three weeks.

267. The circumstances of the latter are very striking. About the first of October the yellow fever broke out in three different places ; on two adjoining squares in the south-eastern part of the town, on three adjoining squares in the northern part, and in a neighbourhood, of a few houses only, a few hundred yards without the town, on the road to Washington.

268. In the former part of the season care had been taken to carry out of the city all kinds of filth, even kitchen slop. But after the third week in August, these measures were entirely suspended, the aqueducts were permitted to be choked up, and the back yards and gutters became the receptacle of all kinds of offal.

269. The squares in the south-eastern part “have been rendered by the recent elevation and extension of Fifth-street, from one to ten feet lower than any street which surrounds them. Two small wooden aqueducts, placed under the new street, constitute the only drains of these squares. These aqueducts became choked up in September, with weeds and trash, and served very imperfectly the purpose for which

they were intended ; for nearly every rain left more or less water on the surface of several lots in the above squares, which sooner or later evaporated amidst the sweepings of kitchens, the rubbish of shops, and the weeds and trash of back yards. The water which makes its way through the aqueducts, falls immediately into a bayou of irregular depth, that meanders for some distance along the eastern side of the new street."

270. A large portion of the three squares in the northern part of the town in which the fever appeared, is from ten to thirty feet below the surrounding land. In rainy weather the water from at least fifty acres settles on one of these squares and the flat land adjoining it. "This low ground was formerly drained by a bayou, which has been filled up, and a ditch more than forty feet deep has been cut through a hill in order to drain the water off in another direction. In 1823, the bottom of the ditch being below the surface of the flat ground, it fulfilled its intention very well." Since that time, the banks of the ditch have fallen in in some places, in consequence of which a considerable part of the rain that falls is detained on the low surface, together with the filth washed from the higher lots.

271. There were three days of rain in the last week of August, which of course washed down into these receptacles abundance of filth. Immediately after the rain, the medium heat at four o'clock, P. M. was for eight days upwards of 91 degrees. The bilious fever was prevailing through the town before, and the yellow fever appeared about the first of October.

272. The inhabitants of the third place mentioned

suffered severely. "A large deep bayou winds along within ten or fifteen steps of the doors of these houses. The road crosses the bayou at the lowermost house." At this place the bayou is filled up, and a wooden aqueduct placed under the road. This was broken in by the weight of the earth in the course of the summer; and whenever it rained, the water from more than an hundred acres, including the eastern part of the town, with all the filth brought down, was stopped. "Of the whole number of persons (about thirty) who remained in the houses on this bayou, on inquiry I could not find one that had escaped sickness." One family returned in November, and nearly the whole of them took the yellow fever, and two died of black vomit, one on the 15th of that month.

273. The yellow fever prevailed at the landing below Natchez in the same year. This fever also has been attributed to exhalations from animal matter in a putrid state, on the following grounds.

274. At the landing, on the margin of the river when the water is high, "there is a warehouse, which in the months of July and August 1825, contained a large quantity of spoiled porter, and sour pork. The owner of the warehouse was constantly engaged in re-packing the pork, the brine from which was permitted to run through the floor into a kind of cellar, which had no outlet to it. Some of the porter barrels bursted, and the spoiled porter also run through the floor into the cellar, with the brine from the sour pork." There were also, not far from this warehouse, two or three houses with putrid fish and oysters in their cellars.

275. The owner of this warehouse, who had been

constantly occupied as abovementioned, was the first victim in the year 1825. Eleven persons more died about the same time, all of whom had been in the warehouse or lived in the immediate vicinity.

276. In the same account, however, are other circumstances, stated very candidly and fairly, which lead directly to another conclusion.

277. "Some few hundred yards above the warehouse abovementioned, there was a boat containing a quantity of rotten corn, which had been sunk in the water, but became exposed in the summer by the falling of the river; and below the warehouse, but not so far from it, there were two or three houses that contained stagnant water; others, putrid sour krout, (as well as) fish and oysters, &c. in their cellars."

278. These minor circumstances would be sufficient to prevent this case from being decisive of the question, but there is another most important consideration.

279. During low water, that is all the summer and fall, the space between high and low water mark, several rods in width, is exposed to the action of the sun. "The surface thus exposed by the falling of the river, consists of mud recently deposited, and of the debris of various vegetable and animal substances, which, during the season of trade, had been thrown out by the flat boats that landed at this place." This whole surface was kept constantly in a proper state to emit foul air, by the rains which fell in every month in the summer, and by the high temperature of the air at the time (265).

The yellow fever appeared at this place on the 21st of August.



280. If this were the only case to guide us in deciding this question, and if these were the only circumstances known, we should be at a loss; both animal and vegetable matter in a putrefying state being present. There is, however, one more circumstance stated that would tend strongly to turn the scale, even if the decision were to rest on this case alone. It is this. "About the third of September, (thirteen days after the commencement of the fever;) the warehouse was cleansed of its impurities and sprinkled with lime; but this *ex post facto* precaution appeared to have no effect in arresting the progress of the disease. The inhabitants soon found, that a removal from the infected district was the only thing which promised safety, and a great majority of them removed accordingly." "The disease continued to prevail among the remaining inhabitants throughout September and October."

281. Here the alleged cause is removed within a fortnight of the commencement of the fever, but the effect continued the whole season. Compare this result with that proceeding from cleansing the Regalia (173. 174). There the effect instantly ceased; evidently because the root of the evil was struck, the real source was removed. Here the disease continued unabated, and drove off all who could get away; evidently because the true source was not touched.

282. The yellow fever which appeared in the same year at Washington, six miles from Natchez, has also been attributed to exhalations from putrid animal matter. The circumstances were these.

283. A grocer removed his store from the landing

below Natchez to Washington in the latter part of summer, and occupied an old wooden house on the north side of Main-street. He carried with him "a quantity of bacon and mackerel, a great part of which had begun to putrefy at the time of its removal, or putrefied soon afterwards." There were about two thousand pounds of bacon, and a gentleman who called to purchase "a few days before the yellow fever originated in Washington," "on examining it carefully," found the whole quantity "in a putrescent state, and none of it fit to purchase." There were also two or three barrels of mackerel in a very putrid state.

The grocer also kept fresh fish for sale, "the heads and entrails of which, besides what rotted on his hands, were thrown into the back yard of the lot."

284. "The principal stores and boarding houses in town, were situated a short distance from the grocery, both above and below it. Both the town markets were within twenty-five steps of it."

285. The first cases of the fever occurred in houses around the grocery, from one to seven doors from it; and a few persons were attacked who lived at a greater distance, but who had been at the grocery, or in its immediate vicinity. These occurred between the 15th and 18th of September: they were ten in number. Between the 18th and 25th of September, the disease sprung up in various parts of the town and its suburbs. Within that period ten persons were attacked in a house sixty yards from the grocery.

By the 25th, or shortly afterwards, the disease appeared in several families in the suburbs, from three

hundred yards to half a mile from the grocery. These persons had been frequently in town, shopping, &c. and therefore near the grocery, which was in the most public part of the town. Two persons living in the country also, who had been in town frequently, and near the grocery, took the fever.<sup>1</sup>

286. Some other circumstances, stated in the account, are however to be taken into consideration.

In the middle of the town is a hollow about fifty yards wide, surrounded by high ground on every side but the north-east. On that side it contracts into a bayou or ravine, which empties about four or five hundred yards off, into a branch of St. Catharine's creek, which flows between Washington and Natchez.

In this hollow was situated the grocer's house and lot. "The earth had been thrown up around the palings of the lot, except at one place (left) to serve as a drain in rainy weather. This drain was choked up with weeds and trash, when I examined it during the progress of the epidemic about to be described, and served but imperfectly the purpose for which it was intended." This hollow was the most crowded part of the town, where the principal stores and boarding houses, and the two markets, were situated. Other lots in this hollow besides the grocer's, it is fair to presume from what may be seen every day in the back yards and alleys of every town, were in much the same situation. The offal of two markets also was no inconsiderable addition to the mass of corruptible matter in the hollow.

<sup>1</sup> This account of the yellow fever in Natchez (265, &c.), at the landing (273, &c.), and in Washington (282. &c.), is taken from the essay of S. A. Cartwright, M. D. Medical Recorder, No. 34.

287. There were in this year thirty-three rainy days in April, May, and June, twelve in July, eleven in August, and four in the first fortnight of September.

In the week immediately following three days of rain in the last week of August, the medium temperature at four o'clock in the afternoon, was upwards of 91 degrees. In the first week of September there were four days of rain, during which the mean temperature at four o'clock in the afternoon, was  $82\frac{1}{2}$  degrees. The rest of the month was clear and hot, there being only one day of rain, and the mean temperature at the same hour being  $83\frac{1}{4}$  degrees. The atmosphere was so damp and warm, that the shoes and boots in a store became mouldy; a circumstance mentioned by Lind as occurring in the hot and damp atmosphere of Senegal in the sickly season.<sup>1</sup>

288. It is clear then, that in this case, heat, moisture, and vegetable matter were present; that is, all the circumstances known to be essential to the production of epidemics (166); and therefore there is not the slightest necessity for seeking any other cause. And even if there were any difficulty in the case, how can we attribute this disease to the exhalations from two thousand pounds of bacon, so little putrid, that a man wanting to purchase examined the whole of it to see if there was any fit to use, when more than two hundred thousand pounds of putrid beef produced no such effect? Or how attribute this effect to two or three barrels of putrid mackerel, when a putrid whale produced none such? or when no epidemic follows when whole fields are covered with putrid fish? (192. 186. 193).

<sup>1</sup> Lind on Hot Climates, p. 35.



289. One very remarkable circumstance in this case is, that the bacon, when it was found to be disagreeable to the neighbours, was privately removed in one night, for fear of a fine, *before the fever broke out*.

Here also, after the alleged cause is removed, the effect appears, increases to a great height, affects the whole neighbourhood, and ceases not until the severe frosts of November put an end to the exhalations from the vegetable matter still abounding; not from the animal matter removed eight weeks before.

Compare this case also with the effect of removing the real cause of an epidemic in the case of the Regalia (173. 174).

290. The manner in which the disease commenced and spread, is relied on as strong evidence of its originating in the exhalations from the animal matter; but the rapidity with which the cases appeared in the distant parts of the town, do not at all correspond with the extent of the alleged cause.

The first cases appeared in the Main street, in the hollow, about the 15th of September; and in about a week, from the 18th to the 25th, the disease appeared in various parts of the town and suburbs, some of them half a mile from the grocery. This rapid spread of the disease corresponds better with a cause originating in the putrefying vegetable matter spread over a wide hollow, extending through a large part of the town, and continuing the whole season in circumstances most favourable to putrefaction; than with a cause originating in one house, and removed before the appearance of the first cases.

291. In this case then, the body of the town is situ-



ated in and about a hollow, closed in by high ground on every side but one, in which there is a narrow vent for the water and filth of the town, into a small stream four or five hundred yards off. The drain through this hollow is stated to have been choked up by weeds, &c. abounding in that rich soil, so that it did not answer the purpose intended.

There was a succession of rains in every month in summer, and the temperature was very high. There were in particular four days of rain in the last week of August, and three in the first of September; during which time, until the commencement of the last rain, the mean temperature was as high as 91 degrees at four o'clock in the afternoon, and  $82\frac{1}{2}$  degrees during that rain.

The fever commenced in a week after the last rain, about the 15th of September, and increased very rapidly until the 25th; the mean temperature, at the same hour, for fifteen days at that time being  $86\frac{1}{2}$  degrees. It prevailed throughout the rest of September and October, during which time the weather continued clear and hot; there being rain on four days only in fifty-four, and the mean temperature of September, at four o'clock in the afternoon, being 83 degrees, and that of October 80 degrees. It ceased not until after several severe frosts in November.

292. The weather in the summer of 1825 was better calculated to produce such an epidemic in such a place as Washington, than any other of which we have any account in that country.

In 1819 a great quantity of rain fell, but four-fifths of it fell in July and August. As there was no swamp

at Washington, and no dams built across hollows, as at Natchez, this great quantity ran off at once, and produced no great effect. In the following years we are led to believe by the publications that there was not much rain until 1823. In this year there was a great deal in the former part of the summer, but the weather became suddenly very dry and warm about the first of July (255).

In 1824 there were in June four days of rain, in July seven, in August nine, and in September, to the 20th of the month, none. In 1825 there were in June eleven days of rain, in July twelve, in August eleven, and in September, before the 20th, four. The mean temperature of August, at four o'clock in the afternoon, was 4 degrees higher in 1825 than in 1824. In both years there were three days of rain in the last week of August; in 1824 the mean temperature of the week following the rain was, at the same hour, 84 degrees, in 1825 it was 91 degrees. These two years were most alike, but 1825 was much more wet and hot.

293. It is evident therefore, that in 1825, of all the years of which we have any account, the constant succession of rains accompanied and followed by extreme heat, was most favourable to the production of the dense gas that proceeds from vegetable matter in a state of putrefaction, in a situation where, as in Washington, there is no great collection of stagnant water, as in ponds or marshes.

294. We have considered the circumstances of these four places separately (262, 6. 265. 273. 282). Further light will be thrown on the subject by viewing them in connexion. It is evident from the existence

of the effect at the landing, at Washington, at Haughton's, and at Natchez, that the cause was likewise present at all four of those points : and as it appeared at very different periods of the autumnal season, it is equally evident that that general cause was so modified by circumstances, that it did not exist in sufficient force to produce the disease in every point at the same time.

295. With regard to the cause, it is certain that exhalations from putrefying matter of some kind produce these fevers, from the cases already stated in which they are manifestly driven by the wind (161 to 163. 223. 224. 229). It is equally evident that this matter must be animal or vegetable, or both, because no other matter can putrefy. The cause in these cases could not have been exhalations from animal matter, because there was no collection of animal matter in 1825 at Haughton's, nor in Natchez, nor at the bayou about three hundred yards from the town. Therefore, as well as because it was present at all the points, vegetable matter must have been the source of the exhalations in these cases.

296. This is confirmed by the consideration of the circumstances modifying the power of the cause. These from long experience have been ascertained to be heat and moisture in such degree as is most favourable to putrefaction. The temperature was alike in all these places : therefore that could not have been the circumstance regulating the period of the appearance of the fever at the different points. It must therefore have been the degree of moisture ; but the degree of moisture could not have influenced the putrefaction

of the animal matter, that being covered from the weather.

297. It is evident, therefore, that exhalations from the animal matter could not have been the cause of this fever; 1st, because it did not exist at three of the places (295); 2d, because the animal matter being covered from the weather, the quantity of rain could not have had any influence in promoting or retarding putrefaction in it; but we know that the quantity of rain is the principal circumstance, in that hot climate, which regulates the appearance and prevalence of epidemics (254); 3d, because the degree of heat, the only circumstance influencing the putrefaction of animal matter sheltered from the weather, was alike in all the places; and therefore if animal matter had been the source of the exhalations producing this fever, it ought to have appeared at all the places at the same time.

298. This (295) is also confirmed by the situation of the different places with respect to the quantity of vegetable matter, and of moisture.

At the landing the great collection of mud and vegetable matter on the beach, and the boat-load of corn, were left completely saturated with water when the river fell (279); and the frequent rains afterwards kept it throughout the summer in a proper state to emit exhalations. The disease therefore appeared at that place about the ordinary time of its appearance in summers wet enough to produce it. It ordinarily appears two or three weeks later at the landing than in Natchez (261, 2). In the latter it appeared in 1823 on the 9th of August, and therefore must have commenced

at the landing in that year about the 25th or 26th of August. In 1825 it commenced on the 21st of that month.

It appeared later in Washington, because the circumstances were not as favourable to the production of exhalations as at the landing. In the latter the source was an extensive beach, with considerable collections of vegetable matter; in the former only a hollow in the town, with the drain through it choked up, and the collections of vegetable matter which grew on the spot, and the offal of kitchens.

It appeared still later at Natchez, because until about the last of August the town had been kept very clean, by carrying off all the offal of every description and by keeping the drains open: and it was not until the last of August that, by neglecting these precautions, the filth began to collect, the drains were choked up, and finally the disease appeared; but late in the season, because the circumstances producing it did not exist until late (268).

299. There are two considerations which alone are enough to determine this question.

(1). Exhalations from animal matter are very offensive, and the dense gas which produces these fevers has no smell.

(2). The presence in the atmosphere of a quantity of the exhalations arising from animal matter, so small as not to be perceived, cannot be the cause of epidemic fever, or the quantity proceeding from a few dead animals near a small town would depopulate it. But we have often known instances of dead cows and horses being left to putrefy in situations, where num-



bers of people were exposed to the exhalations arising from them, without the production of a single case of fever, or of any analogous disease.

300. It has been alleged that this question has a positive and a negative side ; animal exhalations are noxious, or they are not ; and that one instance in which they are shown to have been so, is enough “to prove the positive, or that they are noxious ;” while to prove the negative, that they are not noxious, “it would be necessary to show that under the infinite varieties of exposure, temperature, and other circumstances, in no one instance had it taken place, which is impossible and beyond the power of any individual.”<sup>1</sup>

301. To this it may be replied, that it is not disputed that these exhalations produce noxious effects, viz. nausea, vomiting, fainting, and even death, in persons exposed to an immense volume of them bursting from a place in which they had been confined (180). The question here is, do they produce epidemic disease.

302. With regard to the rule laid down, it is admitted that a single case in which they are shown to have produced an epidemic, is sufficient to prove “the positive,” viz. that they are capable of producing an epidemic. But that is yet to be done ; and for the reasons given above it is apprehended never will be.

303. The cases stated in the paper alluded to, as evidence of the production of epidemics in this way, are not sufficient.

(1). “Haller states, that the members of a convent became ill from the exposure of a single corpse after

<sup>1</sup> Medical Recorder, No. 34, p. 268.

twelve years interment." This is not sufficiently precise. A number of persons confined in a convent, and in an indifferent state of health, might readily have become ill by such an exposure, particularly if they were females. But the other circumstances of the time of the year, situation of the convent, &c. might make it plain that some other cause was in operation. Of all this nothing is stated. On the contrary, I have known some students have, in the very heart of a town, in the chief place of concourse, a number of dead bodies in the midst of summer, in the most offensive state, so that great complaint was made of the nuisance, without producing any ill effect whatever to themselves or others, except some little nausea, and perhaps head-ach in one of them (183).

(2). "Pringle has observed the same effect in crowded hospitals." Pringle's cases occurred in camp hospitals in the midst of abounding exhalations from marshes on all sides.<sup>1</sup>

(3). "Ambrose Parey states that an epidemic appeared in Tuscany from the putrefaction of a whale."

A case has been stated above in which no such effect was produced by precisely such an occurrence. A case is also mentioned by Pringle from Forestus, in which it was alleged that an epidemic had been thus produced, but the whale in that case putrefied in the midst of a marsh (186). In the present case, Tuscany is a country with a marshy shore. As therefore in one case no effect was produced; in a second, although an epidemic occurred, there was a cause present sufficient to produce the effect; and a

<sup>1</sup> Pringle on the Diseases of the Army, p. 15. 22. 25. 26. 32. 61.

strong probability of the presence of the same in the third; it is evident that no reliance can be placed on it. As to exhalations from burying grounds, enough has been already stated to show that they are not capable of producing an epidemic (181, &c.).

304. It has therefore not been proved in a single case that exhalations from animal matter are capable of producing an epidemic, but of the contrary there is abundant evidence (179 to 195).

305. At Mobile, in 1819, the fever was very fatal. It was supposed, that, after the disease began, the population was reduced by the flight of the inhabitants to about five hundred. The total number of deaths from July fourth to December first, was two hundred and seventy-four. The survivors appointed a committee to examine into the causes of the fever. The committee reported, that the wharves, which had been lately built of timber, had been filled up with rotten wood, bushes, shavings, and other vegetable matter, and covered lightly over with swamp mud; that Water-street was filled up with the same kind of materials; and that the docks were clogged with timber, old boats, sea-weed, and other substances in a state of decay, particularly under the stores standing over the water. They added, "that the prevalent north wind in September and October, left the docks, and a large extent of marsh mud about them, exposed to the heat of the sun, and the water, variously obstructed, became itself stagnant and offensive. They further noticed several lots covered with stagnant water, and filled with offal substances; and extreme neglect of cleanliness in the town."

306. There was incessant rain from the 28th of July until the 11th of September, succeeded by a hot sun and drought for sixty-six days. During this time, the docks, and a large extent of marsh mud about them, were exposed to the heat of the sun. During the rainy time, the disease seemed to be confined to those about the river and wharves; but in a few days after the rain ceased, and the hot sun was left to act on the abundant sources of miasmata above enumerated, it spread rapidly through the whole town, and affected even Creoles, and people of colour.<sup>1</sup>

307. The same fever prevailed in many places on the Mississippi, the Tombigbee, and the Alabama; the same wet spell of weather throughout August, and the hot sun and drought for sixty-six days afterwards, producing like effects in all the towns on those rivers, and in the interior country on their branches.<sup>2</sup>

308. Monroe county, Mississippi, is exceedingly fertile, low, and marshy, lying immediately in the forks of the Tombigbee, and Buttahatcha rivers. In the spring of 1822, an unusual quantity of rain had raised the water courses to a height before unknown, even by the Indians. The whole country was nearly inundated. It is added, that, in consequence of the great crop of cotton in the preceding year, enormous quantities of cotton seed were left on almost every plantation in a state of putrefaction. The weather became very warm and sultry after the inundation, and continued so throughout the summer and part of the autumn. In July an epidemic fever made its appearance.<sup>3</sup>

<sup>1</sup> Medical Recorder, No. 10, p. 212.

<sup>2</sup> Ibid. p. 213.

<sup>3</sup> Ibid. No. 28, p. 665.

309. New-Orleans stands on the eastern shore of the Mississippi, and is situated below the level of the river. It stands on a soft and humid soil, and is surrounded by vast marshes. When the river falls in the summer, it always leaves a large space before the city, covered over with mud and putrefying animal and vegetable matter.

The months of April, May, and June, 1817, were very rainy; the country around the city remained for a long time covered with water. A humid and stifling heat prevailed during July and August. About the end of June the thermometer stood at 92 degrees; in July it varied from 86 to 92 degrees; in August from 84 to 94 degrees; and towards the end of September from 80 to 85 degrees.

A destructive fever commenced in July, and raged during that month and August. In the beginning of September a violent storm occurred, and the fever abated. On the 20th the south wind began to blow again, the heat became very intense, and the fever raged with violence. In October it finally disappeared after a violent tempest.<sup>1</sup>

310. In the year 1819 the yellow fever was much more severe than in 1817. Three thousand people died.<sup>2</sup> In the former there was much more rain than in the latter; and it was rather hotter (254).

311. Thompson's Island, off the coast of Florida, is about seven miles in length from east to west, and scarcely two miles wide. It is nowhere more than ten feet above the level of the sea. There are on its

<sup>1</sup> Medical Recorder, No. 6, p. 217, by M. M. Gross, et Garadin

<sup>2</sup> Ibid. No. 10, p. 213.



surface a number of low places in which the water collects during the rainy season, and several of these ponds are not entirely dry throughout the summer. The harbour is at the west end, and near it is a pond, from which a drain had been cut to let off the water into the sea.

About the last of May, 1823, the rains commenced and continued several weeks. In April and May the thermometer ranged from 75 to 90 degrees; in June, from 82 to 90 degrees; in July, from 82 to 94 degrees; in August and September, from 85 to 97 degrees. In the two latter months it was seldom lower than 90 degrees at meridian.

Towards August the pond abovementioned "was very much diminished by draining and evaporation, leaving a surface of mud exposed to the sun." Only a few cases appeared before August: from the 15th to the 20th some cases appeared, the weather having been unusually hot; after the 20th it raged until the middle of September, when the ships were ordered to Norfolk, and there were only about a dozen persons left behind who had not been sick. Some slaves from Charleston, it is believed, all escaped.<sup>1</sup>

312. In the state of Alabama there is a great variety of soil. The first and second bottoms on the sides of the rivers are very rich; these are more or less inundated annually in the months of March and April, and from them arise, during the heat of summer, which is long and intensely hot, "noxious exhalations which occasion cases of the endemic fever, of the bilious remitting and intermitting types."

<sup>1</sup> Philadelphia Journal, &c. No. 15, p. 53, by M. Morgan, M. D.

Of the upland a great portion is barren piny land, which is every where healthy. Much of the upland is a limestone country ; in many places the rock appears above the surface, or lies so near it that there is not sufficient depth for the growth of trees : these bare lands are called prairies. There is a great scarcity of water, (so that crops are very uncertain,) and what water there is, is very bad (196). "In point of health, however, the prairies are scarcely surpassed by any portion of the state."

313. March and April, 1823, were extremely wet and rainy. Early in May the hot weather of summer began with considerable intensity ; the mercury frequently rising to 80 and 86 degrees in the heat of the day in Cahawba. Several slight cases of fever appeared. In the course of the month the cases increased in violence ; and by the middle of June numbers were ill.<sup>1</sup>

314. Waynesborough is a small village in Burke county, Georgia. An inconsiderable stream runs through the town, but in dry summers it contains no water. There is another within a mile. They are bordered more or less by low ground. At the upper end of the village is a pond of about two acres ; and on the south-south-west and west there are three smaller ones. Except in very dry seasons they always contain water. Within a mile of the town, south and south-east-by-south, are two mill-ponds. One of them was, in 1802, in a neglected state, most of the water having passed off into the old channel, leaving a surface of an acre and a half covered with dead

<sup>1</sup> Philadelphia Journal, &c. No. 18, p. 256, by J. W. Heustis, M. D.

trees, &c. and a few inches of water. The other had been made five or six years, then supplied a grist-mill, and contained a number of dead trees, most of them standing, and other vegetable matter. In the neighbourhood there are a great number of ponds of various sizes, at some seasons, (of course in the heat of summer,) affording pasturage for cattle. Several small creeks pass through the neighbourhood, many of them, in wet seasons, furnishing water enough to grind corn and wheat, but often dry.

315. In July and August, 1802, a great quantity of rain fell. The waters in many wells rose over the top. Immense quantities of peaches rotted, and the crops were much injured.

The mean temperature of the month of July was 81 degrees; of the month of August,  $80\frac{9}{10}$  degrees; and for the first six days of September, the mercury ranged from 73 to 92 degrees. The weather in the last of August and first of September, about three weeks, was unusually dry.

The *usual* endemic made its appearance in June. Cases were more numerous in July and August, but it did not exhibit such marks of violence in either of these months as in September. Very few escaped an attack, and many relapsed two or three times.<sup>1</sup>

316. The city of Savannah is built on the south side of the Savannah river, and about seventeen miles from the Atlantic ocean. The most compact part of the city is built on the flat ground on the river: on the bluff, which is from thirty to forty feet in height above the flat, the town in 1806 was not compactly built.

<sup>1</sup> Medical Repository, Vol. 9, p. 36, by Dr. Joshua E. White.

Adjoining the east and west boundaries of the city, the ground was originally swampy, but is now converted into rice-fields. South-west and south-east from the town there are considerable and extensive swamps, principally remaining in a state of nature. Both sides of the river, from the city to the ocean, consist of swamps, which in 1806 remained uncultivated, except for a few miles on the south side. The land above the city is also under rice cultivation. There are also a few small ponds bordering the south common, which are generally dry in the summer season, unless it is very rainy.

Immediately in front of the city is a flat island, often overflowed, and the greater part of it cultivated as rice ground. It extends several miles above, and some distance below the town. The Carolina shore, beyond the island, is also swampy, and is a little more than a mile from the city. Savannah, in short, is almost surrounded by swamps and low grounds.

That part of the town below the bluff is the most sickly ; it is nearest the rice-fields on the island, and on the Carolina shore, and has nothing but a narrow river to intercept the miasmata. The buildings at the eastern boundary of the city are also very unfavourably situated for health. They are immediately in the neighbourhood of extensive rice-fields. Those who reside at the western end are also exposed to the action of miasmata. The central parts are most healthy.

317. It has been observed that the east wind, during the summer and autumn, is peculiarly unhealthy. It passes immediately over the whole line of swamps and rice grounds between the city and the ocean.

318. The rice grounds in the fall of the year, when the crop is cut off, are left in a state the most favourable to produce miasmata: the water having lately been drained off, vegetable matter abounding, and the whole surface being completely exposed to the action of the sun, miasmata must abound. In these months accordingly Savannah is always sickly.

September and October are the most sickly months, and October the most fatal. Out of a white population of 2,926 persons in 1804, in September 49 died, and 27 in October; this unusually small proportion for October was the effect of a hurricane on the 8th of that month, which dispersed the miasmata. In the summer of 1805 it was supposed that there were not more than 2,500 white persons residing in the city; of these in September 39 died, and 72 in October. In the six summer and autumnal months of that year 175 white people died.<sup>1</sup>

319. Augusta, in Georgia, stands upon an extensive plain, surrounded by high hills on the north and west, and nearly encompassed on the south and east by a large swamp, generally covered in the autumnal months by stagnant water.

The bilious remitting fever prevails from the first of June. In dry seasons it is more severe: in wet there are fewer cases and they are milder.

In 1804 there were heavy rains about the first of August, and the weather was very hot. After that time there was a long continued drought, and an epidemic fever which terminated about the first of October after much rain, thundering, and cool nights.<sup>2</sup>

<sup>1</sup> Med. Repos. Vol. 10, p. 352, and Vol. 11, p. 12, by Dr. White.

<sup>2</sup> Ibid. Vol. 9, p. 125, by Dr. Smelt.



320. Charleston, South Carolina, is situated at the confluence of the Ashley and Cooper rivers, on ground subject to be overflowed.

The summer of 1817 was uncommonly wet : such floods of rain had seldom or never been seen by the oldest inhabitants. The weather was also steadily warm ; the thermometer ranged from 82 to 88 degrees.

The common bilious fever of the climate was unusually severe. In July the yellow fever appeared in the town, was very severe, and declined rapidly in the second week in October.<sup>1</sup>

321. On the river Roanoke, in North Carolina, the lands are divided into first and second low grounds, and are very fertile. The low grounds are intersected with ponds and marshes, which in dry seasons become entirely dry. The high lands have a number of swamps, &c. and are so flat, that the water after great rains remains a considerable time on the surface. The low grounds are generally overflowed several times every year. The summer season is generally excessively hot.

Remitting and intermitting fevers are epidemical every summer and autumn. They generally begin in July, and continue until November, and sometimes longer.<sup>2</sup>

322. The lower part of the state of North Carolina is flat, and the margins of the rivers are marshy, and are subject to inundation by every tide. Wilmington is situated on the east side of Cape Fear river, upon a sterile sand hill. Opposite to the town is an island

<sup>1</sup> Philadelphia Journal, &c. No. 6, p. 250, by H. Dickson, M. D.

<sup>2</sup> Medical Repository, Vol. 11, p. 337, by Dr. Pitt.

containing many thousand acres of swamp, extending far above and below the town. Parts of this are appropriated to the cultivation of rice, and from north-east to south-east the town is surrounded by rice-fields.

The wharves are badly made and often overflowed. In the neighbourhood of the square, on which the fever appears first and is most severe, there is (1821) an unfinished wharf, partly filled with decaying vegetable matter, and overflowed by the tides. The docks are extremely filthy, and the cellars are very wet, requiring to have the water taken out almost every day. In the sickly season many people go off and leave their stores and cellars locked, and in them potatoes and other vegetables are left to decay.

In the commencement of the season of 1821 there were excessive rains, succeeded by a long drought and great heat. In the fall of the year the yellow fever prevailed.

323. The spring and early part of the year 1796, was remarkably wet. About the middle of the summer the weather became dry and unusually warm. The bilious fever and dysentery prevailed, and great numbers died. In August, September, and October, one hundred and fifty persons died out of one hundred and twenty or thirty families.

324. The summer of the year 1804 was, in the northern part of Virginia, by far the wettest season remembered by the oldest inhabitants. It is stated in my notes of the weather and diseases of that year, made in Leesburg, that it rained on fourteen days in May, on twenty days in June, on ten days in July, on nine days in August, and on four in September. The

growth of grass, spring crops, and garden vegetables was most luxuriant, and immense quantities of vegetable matter were spread over the face of the country in a state of putrefaction.

The weather was not as warm as usual in June; in July it was warm, but sometimes cool; in August it was very warm, and some days were extremely hot; in September the weather was dry, clear, and pleasant.

325. The epidemic in Loudoun county commenced about the 20th of July: in August and September an incredible number of people were sick. The disease was an inflammatory bilious fever, requiring free bleeding. The high lands were most severely affected; in the low grounds of the Potomac, which were repeatedly inundated, and were much of the time under water, the disease was milder.

On the first, second, and third of October, there were very heavy frosts; which, together with the cool weather following, put a sudden stop to the disease.

326. The weather and the disease were the same in all the neighbouring counties of Fairfax, Fauquier, Frederick, Berkeley, and Jefferson;<sup>1</sup> and also in the neighbouring parts of Maryland, and Pennsylvania.<sup>2</sup>

327. For many years after this, there was no epidemic that excited much attention. The summers were very cool, some of them remarkably so. The mean temperature of June, July, and August, of the twelve years from 1806 to 1817, inclusive, was only a

<sup>1</sup> Medical Repository, Vol. 8, p. 252. <sup>2</sup> Ibid. 371. 381. 345. 367.

Note. The account of the fever in Wilmington, N. C. (322), is from the Med. Recorder, No. 17, p. 86, by J. Hill, M. D.; of that in 1796, (323), from the Med. Repos. Vol. 2, p. 153, by A. J. De Rosset, M. D.

small fraction above 75 degrees; more than five degrees lower than our hot summers.<sup>1</sup>

328. The first considerable autumnal epidemic after 1804, occurred in the year 1821. The spring and summer of that year were not remarkable until towards the end of July. In the latter part of that month, an extraordinary quantity of rain fell in the course of two days. In the upper part of Fauquier county about twenty mill-dams were washed away, and the whole country was deluged by the most incessant torrent of rain for about twenty-four hours, that I ever witnessed. An incredible quantity of every kind of vegetable matter, logs, brush, hay, wheat in the straw, &c. was left here and there on the banks of the streams. The whole country was perfectly saturated with water, the swamps were all full, and there was a great deal of water standing about in the low grounds.

329. The county of Fauquier is near sixty miles in length, and from twenty to thirty in breadth. The upper half is mountainous; the lower is comparatively level, and in many places flat. A number of large streams pass through it, and there is a considerable proportion of wet land, particularly in the south-east part, in the Marsh.

330. After the great rain abovementioned, the weather was hot and very dry throughout the season. In the upper half of the county, there was for a short time, in the immediate neighbourhood of the mill-ponds, a number of cases of autumnal fever, some very severe; but as soon as the bottoms of the ponds became dry, there was scarce any sickness in the coun-

<sup>1</sup> Medical Recorder, No. 1, p. 142.

try (155). In the lower half, however, and in the county below, still more flat and marshy, the most terrible epidemic prevailed.

331. The same rain, and succeeding dry warm weather, produced the same deadly epidemic in the neighbouring counties, Loudoun, Fairfax, Prince William, and Culpepper. It produced an epidemic also in the southern and the south-eastern part of the state;<sup>1</sup> and no doubt in other parts of which no account has been published.

332. In the midst of the distress produced in almost every part of the counties abovementioned, a tract of country of fifty or sixty miles square, there were a few striking exceptions. The upper part of Fauquier county was one, and Centreville was another (148). Between the situation of this village and that of Dumfries, in the neighbouring county of Prince William, and the consequences in both, there was a strong contrast. Dumfries is situated near an extensive marsh: in consequence of the great rain in July it also had many ponds in and about it. It was stated at the time that there were only three persons who escaped an attack of the autumnal fever in that season.

333. Surry county, Virginia, lies adjoining the south side of James river; on the west it has a creek; on the south the Black-Water swamp; and on the east another creek. The banks of James river are very high for the most part; but there are three creeks besides those already mentioned, extending from three to five miles into the county, besides several small inlets of much less extent. There is a great deal of

<sup>1</sup> Medical Recorder, No. 19, p. 420, and No. 17, p. 73.



marshy land about these creeks. There are also a number of mills, with extensive ponds subject to become dry in the heat of summer. In the middle and southern sections of the county are several large swamps.

Some of the situations immediately on the river are sickly, but most of them are the reverse. The middle of the county is very sickly.

334. The latter part of the summer, and the whole autumn of 1820, were unusually sickly; but on the approach of winter it became healthy. The summer of the year 1820 was very dry.

335. In 1821 the spring was backward; the latter part wet. The summer was hot, with refreshing showers until the first week in August; from which time until the third of September the weather was very dry. On that day there was a violent wind, with torrents of rain, which kept the earth wet until October. The weather was unusually warm for the season, and very dry and sultry in October, until which time there were not many cases of bilious fever; but between the first and tenth of that month the cases increased very rapidly, and became more violent.<sup>1</sup>

336. In the same autumnal season the yellow fever prevailed in the cities of Alexandria and Norfolk; neither of these towns had suffered severely from epidemic disease for almost twenty years.

337. The city of Alexandria, in the district of Columbia, stands on sandy ground considerably above the level of the river. It has, however, a very swampy piece of ground above and below, and very

<sup>1</sup> Medical Recorder, No. 17, p. 73, by W. H. Finch, M. D.

near to it. From 1795 to 1800, it was difficult to wade through either of them; and the lower part of the southern swamp was impassable or nearly so, the Potomac river covering the greater part of it at high tide. It had, however, been protected in some measure from the water of that river and the adjoining creek by causeways, and had been partly drained by very large ditches; insomuch, that about 1800, it was enclosed and used as a grazing ground. A branch of the swamp at the upper end, formerly extended around what was then the back of the town, at a short distance west of the market-place. It is now dry, and streets or causeways are extended across it. The water that runs down through this hollow way, from a considerable extent of ground, passes through trunks placed at the bottom of the causeways. Great rains not having sufficient vent by these trunks, the water rises and forms a kind of pond for a short time, leaving, as it slowly drains off, the filth, &c. brought down from above, spread over the surface of the low ground.

Behind the town at a very short distance, there is a considerable range of hills; between it and the town is a corresponding range of rather low ground. In wet weather, the whole was formerly miry and the resort of millions of plovers. The water from this ground vents itself by a small stream near West-End, through a swampy piece of ground, into Hunting-creek.

338. Thus situated, Alexandria has frequently suffered from epidemics, particularly in 1793 and 1803. In the former year a severe bilious fever prevailed; in the latter the yellow fever: in both those years the

summer was hot and dry. From 1803 to 1821 there was no considerable epidemic in this city; the summers in that interval were cool and healthy (327).

339. In the year 1821 this town suffered very much from the yellow fever. After the last of July the summer was very dry and hot. I ascertained from particular examination and inquiry, which was the sole object of the visit, that the fever prevailed, with the exception of one spot, on the borders of the low ground west of the market house, and along the side of it to the river; along the wharves, some of which were then unfinished; at the lower edge of the town, and at West-End.

340. The spot above excepted is in the heart of the town; ten or fifteen persons died near the intersection of Fairfax and Prince streets. On inquiring into the cause of this very partial effect, I learned that a person living in one of the houses in Fairfax-street, had had an old well cleaned out, and the filth was thrown into a narrow alley passing in the rear of the lot. In a short time, the people who lived near could not keep their windows open on account of the smell. Complaints were made, and orders given for its removal; it was done, however, in a very dilatory manner. There was but one cart employed, and there were twenty-seven loads of this offensive matter, which of course was for several days continually in agitation. The middle of this square is low, and many years ago was often under water for a considerable time. When I visited it, the smell continued to be very perceptible.

In the house, from the yard of which the filth was thrown, there died three or four persons; in several

adjoining houses, from one to three. In a house almost immediately opposite to the one first mentioned, two died; near it one; and at the south-west corner, at the intersection of the above named streets, two or three died; in all about twelve persons. Among them were some of the worst cases that occurred in town, and every one but one within fifty or sixty yards of the mass of filth in the alley.

341. It is probable that such a change has taken place in the situation of the low grounds about Alexandria, as to render its health dependant on a different state of the weather from that which formerly influenced it. The summer of 1803 was dry; at that time the low grounds were still considerably marshy, in which state a dry summer would be most likely to produce an epidemic. In 1821, however, when there was a great fall of rain in July, followed by hot weather, an epidemic prevailed; and in 1822, which was very dry, the town was healthy. This would indicate that the low grounds have become dryer, and require wet weather to produce an epidemic; and this change in those grounds is very probable, inasmuch as in 1800 they had become sufficiently dry for a pasture.

342. The yellow fever raged in Norfolk in 1800. The ground on which the city stands is a sort of peninsula. "The line which marks out the boundary of the town on the side next the river, comprehended originally more water than land on that side of the main street." In some places the wharves are advanced upwards of an hundred yards into the river, as far as this boundary line. That part of the city where the fever chiefly prevailed, stands entirely on made

land, reclaimed by sinking log pens and filling them chiefly with green pine saplings, which are slightly covered over with earth or gravel. In some places large openings are left for docks: in others, wharves are formed next the channel of the river, while the interior parts are covered with water. Through the whole of this wooden fabric, the water of the river penetrates. There are also some places left in their ancient state, and consequently have become equivalent to sunken places, and are the receptacles of all kinds of filth. "In these ponds, or rather sinks of putrefaction, though sixty yards or more from the river, the tide ebbs and flows through the open texture of the adjacent reclaimed ground." At low water they are not dry, but are the resort of hogs in hot weather. In addition to these circumstances, a short time before the fever commenced, a cargo of spoiled West India fruit was picked over, and the greater part thrown into a pile, and left until after the occurrence of some cases.

343. Rains had been very frequent in June and July; but instead of cooling the air, it was observed that they were invariably followed by more intense heat. For more than two months after the 25th of June, the inhabitants of Norfolk lived in an atmosphere heated above 85 degrees of Fahrenheit, sometimes as high as 94 and 95 degrees, but very frequently upwards of 90 degrees. "Such a long tract of intensely hot weather, is not, we believe, within the remembrance of any person now living in this place." The fever appeared close to the abovementioned ponds. Two young men in a vendue store, at the



spot where the oranges and limes lay, died among the first.

314. For several days in the last of July and first of August, the weather was cooler than before; and there was a temporary suspension of the disease. The weather became steadily hot again about the sixth of August, and continued so throughout that month. The disease returned with the hot weather, and continued with unabated violence to the end of the month. On the 30th there was a considerable fall of rain, followed by three or four days of cool weather, with a brisk northerly wind. On the fourth of September, the thermometer stood at 60 degrees. Attacks of the fever were less frequent: but this might partly be accounted for by the reduced number of persons liable to take the fever. About the middle of the month it again became sultry, and a number of young persons who had hitherto escaped were attacked. On the fifth of October a deluge of rain fell, accompanied by a very high wind from the north-east; the weather became suddenly cold, and in a few days not a vestige of the yellow fever was to be seen in Norfolk. The weather became hot again about the middle of the month, the thermometer standing at 80 degrees in the shade. Several persons who had returned to the city, and some strangers, were attacked, and some fell victims to the fever.<sup>1</sup> Here is strong proof of the correspondence between the minute variations of the disease, and the varying state of the weather; and proper care would soon put us in possession of abundance of testimony to the same amount (214. 219).

<sup>1</sup> Med. Repos. Vol. 4, p. 329, by Drs. Selden and Whitehead.

345. The fever again prevailed in 1801. The spring was extremely cold and late; frequent rains in June, and a cloudy sky, kept the weather cool. It varied from 70 to 87 degrees until the last week, when the weather became serene and intensely hot, followed by occasional rains. This weather continued until the 23d of August. Diarrhœa and dysentery began to appear in June, and increased as the summer advanced. During the month of August, some cases of yellow fever were reported to have occurred about the wharves.

On the first of September the weather became extremely hot, calm, and serene. Not a cloud was to be seen for eleven days; during which time the mercury in a thermometer, fixed in a passage with a free circulation of air, in a part of the town well ventilated, and not crowded with houses, frequently rose to 94 degrees, and was seldom below 90 degrees in the hottest part of the day. At ten o'clock at night, during this time, it was found several times standing at 90 degrees.

Under these circumstances, the "intestinal fever entirely disappeared;" and by the seventh or ninth of the month, the cases of yellow fever had become so numerous as to deserve the name of an epidemic, and to rouse public apprehension.<sup>1</sup>

346. The lower part of this country, about Norfolk, is an uniform plain, intersected by rivers and creeks of tide water. The whole country is universally unhealthy. The inhabitants show the effects of a pernicious atmosphere. A thin sallow appearance is more common than we have ever observed in any

<sup>1</sup> Medical Repos. Vol. 6, p. 247, by Drs. Selden and Whitehead.

other part of the world, even in the hottest climates ; and they are commonly tormented with agues one half the year, and scarcely ever get clear of the appearance of them.<sup>1</sup>

347. The yellow fever prevailed in Norfolk in 1821 also. On the 20th of July a vessel arrived in the harbour from Guadaloupe ; and after “having discharged her cargo at an upper wharf, her bilge water was pumped out on the dock between Southgate’s and Warren’s wharves, which was found to be so putrid and offensive, as to render it expedient that the doors and windows of a neighbouring house should be closed.” Notwithstanding this precaution, every individual of the family, seven in number, were taken sick, except the master of the house, who was from home when the bilge water was pumped out. Two of the family died. A clerk in a warehouse, about the same distance, fifteen or twenty yards, from the vessel with the other house, sickened and died. A young man who assisted in pumping the vessel, and a boy who had frequently been about her at the time, both died.

348. To this bilge water the disease, which prevailed throughout that fall in Norfolk, was principally attributed, on the ground of the facts stated, and on that of the fever not having prevailed for many years before in that town.

The cargo of this vessel was rum, molasses, and sugar. The drainings of such a cargo, Dr. Ferguson says, “creates a stench that is absolutely suffocating to those unaccustomed to it ; yet fevers are never

<sup>1</sup> Med. Repos. Vol. 5, p. 430, from Barnwell’s Phys. Investigations.

known to be generated from such a combination.”<sup>1</sup> It is moreover admitted that bilge water had been frequently discharged at the wharves with perfect safety; indeed it cannot be doubted that it is every year done in many instances. It is therefore admitted, that a certain state of the atmosphere was necessary to give effect to the insupportable stench of the water in this case. Let us then inquire into the state of the atmosphere in Norfolk at that time.

349. The spring had been backward and wet, and the summer set in very warm in June, and the disease appeared in August. The first cases appeared as above stated near a very filthy dock; but within a few days after, the disease also appeared in a very dirty lane, crowded with people in the lowest circumstances, mostly Irish recently emigrated, very intemperate, and dirty in their manner of living. It was very near the dock, and had another very filthy one on its other side. The last mentioned receives all the offal of the neighbourhood, and at low tide is bare and exposed to the action of the sun for a considerable distance from its head. The fever extended gradually around the head of the dock last mentioned; it appeared also in a block of wooden buildings under which the tide flowed, and equally unclean with those in the lane above mentioned. In a very short time it embraced that whole section of the town, and was almost exclusively confined to it.

350. The disease was more or less violent as the thermometer rose or fell. No very material change, however, occurred until the third of September, when

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 14.

there was a hurricane from the north-east, shifting after a short time to the north-west, and accompanied by torrents of rain. The water of the river rose above the wharves, and covered all that part of the town in which the disease prevailed. This moderated the disease considerably, but towards the end of the month it began to increase, but was of a milder character; but there were some bad cases in October among those who returned from the country too soon.<sup>1</sup>

351. It is evident from this statement that the circumstances of the town were precisely such as have in a thousand instances produced such a fever; that in the time of its rise, August; the manner in which it appeared in different places in the flat part of the city, about the docks; its limitation to the foul and crowded part of the town; its prevalence through the summer; the check from the hurricane; its increase after the storm, that having occurred early in the season when the heat was still considerable; and in its cessation only when the weather became cold, it corresponds precisely with the fevers every where occurring in such situations in a warm climate. Its revival after the hurricane particularly shows what was its real cause. The whole foul atmosphere of the town must, on that occasion, have been driven far away; and the cause must have been regenerated from the same filthy docks, alleys, &c. saturated with water during the hurricane, but in a milder degree on account of the lateness of the season.

352. The very same weather, first wet and then hot and dry, produced a very similar fever in all parts of

<sup>1</sup> Medical Recorder, No. 17, p. 60.



the state of Virginia, and in many other states (328, &c.); and the yellow fever prevailed at the same time in Alexandria and in Wilmington, North Carolina (322. 339). It is evident, therefore, that the fever would have occurred here also, if the vessel above-mentioned had not arrived.

353. It is very probable the nausea, &c. produced by the stench, so deranged the system as to bring on a fever in persons already on the verge of an attack; but that it could do no more is evident, from what Ferguson states, and from the admission that bilge water has often been pumped out at Norfolk without injury to any body.

354. As to the circumstance of the absence of the fever from Norfolk for a number of years before 1821, it will be remembered that the summer seasons for many years before had been very cool, and unusually free from epidemic diseases, except in the extreme south in the wet summers 1817 and 1819 (254).

355. In Philadelphia, cited because we have such ample accounts of the epidemics that have prevailed in it, "from 1805 when it last threatened to assume an epidemic character," "yellow fever was met with in a few sporadic cases only, which seldom attracted much notice." From 1812 "yellow fever became a stranger to us (in Philadelphia) even in a sporadic shape, and as it disappeared, a kind of interregnum ensued, in which no disease showed itself with violence or to great extent. A period of unexampled health existed, especially during the cool summers of 1814 and 1815. In the summer of 1818 diseases began to assume a more exalted character, and *two* well

marked cases of yellow fever occurred. In 1819 the summer diseases exhibited a still nearer approach to their former state, and were of more frequent occurrence." Twenty-four cases of yellow fever occurred. In 1820 the fever was still more violent.<sup>1</sup>

356. From 1805 until 1818 then, the summers were uncommonly healthy ; and from the table of the temperature of the summers in Philadelphia, published in the *Medical Recorder*,<sup>2</sup> it appears, that the mean temperature of June, July, and August, of the twelve years, was 75 degrees 7 minutes ; whereas, in the seven years from 1793 to 1799, inclusive, in the four hottest of which the yellow fever was epidemic, and in the three coolest of which there were a few cases, the mean temperature of the same months was 80 degrees 12 minutes.

The coolness of those summers was so remarkable that attempts were made in the public papers to account for it ; and among other hypotheses advanced, it was alleged to be the effect of the immense islands of ice which about that time were frequently met with off the coast in summer time.

357. When the autumnal fever in Philadelphia began again to show marks of violence, the same thing was observed to occur in various parts of Virginia, Pennsylvania, and Maryland.<sup>3</sup> About the same time the summers became hotter than they had been for many years. In "a condensed view of the greatest heat" which occurred at Harrisburg, Pennsylvania, in the years 1819, '20, '21, and '22, it is stated that

<sup>1</sup> Jackson on the malignant fever of 1820 in Philadelphia. *Philadelphia Journal*, &c. No. 2, p. 319. <sup>2</sup> *Medical Recorder*, No. 1, p. 142.

<sup>3</sup> *Ibid.* No. 21, p. 126, by Dr. Agnew.

the thermometer stood at and above 80 degrees in each of the months from May to September, inclusive, excepting the month of May, 1820, in which it is said it stood at 80 degrees. In 1819 and 1820 it was sometimes as high as 95 degrees.<sup>1</sup>

358. It is evident from this statement why Norfolk, as well as other parts of Virginia, Maryland, and Pennsylvania, was exempt from severe epidemics in the cool years abovementioned, and why it suffered when the summers became hot again. In the same year, 1821, Wilmington, in North Carolina, also suffered from the yellow fever (322). Alexandria, in the district of Columbia, experienced the same misfortune; in the latter, as in Norfolk, there had been no appearance of the disease since 1803.

359. The valley of the Shenandoah lies between the Blue Ridge and the North Mountain, and is perhaps twenty miles wide. The northern branch of the Shenandoah, about forty-five miles from the Potomac, crosses the valley from the North Mountain towards the Blue Ridge, and at a short distance from the latter turns, and flows along the foot of the mountain into the Potomac at Harper's Ferry. Near the middle of the valley the Opequon creek passes along nearly parallel with the Shenandoah, and likewise empties into the Potomac.

360. This valley and the adjoining mountains afford an excellent field for observing the effect of different kinds of weather in producing epidemics. In it there is almost every variety of soil and situation. A vein of slaty poor land, several miles wide, extends

<sup>1</sup> Medical Recorder, No. 21, p. 126.

from one end to the other, through which the Opequon creek passes. East of this lies an exceedingly rich tract of land, extending to the Blue Ridge, through which the Shenandoah flows. In this tract there are extensive plains, still so wet as to retain the name of Marsh, as the Long Marsh, &c. West of the Opequon hills there is another tract of good land, extending some miles to the hilly country at the foot of the North mountain. In this there are also plains of considerable extent, which retain the name indicating that they were formerly marshy. These different tracts are long and narrow, extending lengthwise in the valley. There are some considerable streams which empty into the Opequon or the Shenandoah; and on most of these streams there are many mill-ponds. The Shenandoah has a great number of marshy spots about it in dry weather, produced by obstructions made in it with a view to throw the water to one side, and improve the boat navigation (165). There has been as great a variety in the seasons from 1822 to 1826, as in the situation of the different parts of this valley.

361. The year 1822 was so dry throughout the summer that the grass was entirely bleached, and in many places the corn also, as effectually as it would have been by the severest cold of winter. This drought prevailed also in the neighbouring states of Maryland, and the central part of Pennsylvania.<sup>1</sup> This year was remarkable for general health.

362. The year 1823 was the wettest season since 1804 (324). This was a very common observation among those who remembered the latter. The whole

<sup>1</sup> Medical Recorder, No. 21, p. 140. 141.

country was wet throughout the summer, meadows became marshes, and the roads were generally miry. The weather was also warm.

Sickness was as general in this year as health had been in the preceding. Scarce a family escaped; and many families were all sick. The occurrences of the autumnal season bore a striking resemblance to those of 1804. In some houses, in both years, I found not an individual able to provide for the youngest children, except at particular times of the day when the fever remitted, and then of course with great inconvenience and suffering. Every bed was occupied, some by two or three persons, and it sometimes happened when one fainted, that there was not another able to give assistance.

363. To this general prevalence of health in 1822, and of sickness in 1823, and also in 1821 (328), there were some striking exceptions, which remarkably support and confirm the general doctrine (178).

Harper's Ferry was sickly in 1821 and in 1822, but healthy in 1823. Shepherdstown, on the Potomac, was sickly in every one of the three years; as was also Waterford, in the neighbouring county of Loudoun.

364. Harper's Ferry is a village situated in the obtuse angle formed by the junction of the Potomac and Shenandoah, on a very narrow slip of land, perhaps fifty or sixty yards wide, between a high and steep hill or mountain, and the water. The latter part of the summer of 1821, it was above stated, was very dry, and the bottoms of the two rivers were exposed to the heat of the sun for a length of time. The water in a canal which supplies the public works was very low.



and an attempt was made in the heat of the weather to clean it out. Numbers of the men sickened in the very act. This town was also sickly in 1822, for the same reason. In that dry year the bottoms of the rivers were more exposed than in the year before. In the year 1823, however, Harper's Ferry was comparatively healthy; and it was observed that the rivers were fuller than they had been for some years. The rain which fell in 1821 was all, or nearly all, before the last of July. In 1823 it rained throughout the summer (362).

365. Shepherdstown is situated on the Potomac also, and suffered in 1821 and 1822 with Harper's Ferry, and from the same cause, the exhalations proceeding from the bottom of the river. It differed, however, from that place in being very sickly in 1823 also.

This town stands on the bank of the Potomac, and through it, nearly at right angles with the course of the river, runs a small stream which supplies some mills in the town. Immediately back of the town, the ground through which this stream passes is low, and in wet weather marshy. Thus in dry hot summers the inhabitants suffer from the exhalations from the bottom of the river, and in wet years from the adjoining marshy ground.

366. Waterford is situated on the east side of the Ketockton creek, partly on a low ridge running nearly parallel with it, and partly on the flat between the ridge and the creek. This is a sluggish stream in that part of its course, running through a low flat piece of ground abounding with vegetation. There is a dam

across it some distance above the town; and below the dam in summer time, the water is so low, that the bed of the stream is little more than a succession of ponds. Between the creek and the town, which is a very short distance, there is also a mill-race, itself very low in hot weather; and some ponds where brick have been made. Thus situated, Waterford is in wet seasons sickly, on account of the exhalations from the whole surface of the low grounds; and in dry seasons, on account of those from the bed of the creek, the brick yards, and the race. The mill-pond may have some effect also, in hot dry summers, as it lies southwest from the town.

367. Thus excessive rain produces in dry places sickness (362. 158), and in wet places health (364. 156); while excessive drought produces in dry places health (361), and in wet places sickness (364).

368. In the year 1824 the weather in July was very hot and very wet; almost every day there was a heavy shower, and the weather notwithstanding continued warm. In the midst of this weather the fever made its appearance, a month earlier than in the preceding year, and there were great apprehensions of a still more severe epidemic. After July, however, the weather became very dry, and continued so for the rest of the season, and the sickness abated, except near marshes, ponds, and streams.

369. In 1825 the weather was also dry, and the country generally healthy. About marshes and ponds there were some very severe cases. A family who lived on a small farm, which had been generally healthy, were attacked, every one of them, in the month

of September, and five out of eight died. The symptoms were of a high grade; one had hemorrhage from the bowels; several, invincible constipation.

There was in the barn-yard of this farm, a pond for the purpose of watering the cattle. The year 1824 was dry, except in July; 1825 was more so, and this pond was reduced almost to dryness. The bottom was a mass of filth, nearly black, which had been collecting there for years. It was between south and west of the house, and very near it; and almost the whole family were about it every day, some to take care of the horses and others to milk the cows.

370. The year 1826 has also thus far been dry in the greater part of the valley. Some parts have had heavy rains, but the waters have been very low. The months of May and June were excessively hot. In these circumstances the usual fever began very early in some places near the Shenandoah. May was very sickly. A remarkable change occurred in the weather in July. It became very cool, and has continued so until this time, September. The weather is unusually cool and pleasant. Near the water courses the sickness continues to be considerable. Harpers Ferry is suffering very much. Those parts of the country not near water are healthy.

371. On Mill creek, in Berkeley county, there is a mill-pond, which had been for many years gradually filling until a large part of it had become shallow. The immediate neighbourhood suffered considerably in the summer and autumn for a number of years, but particularly in the dry seasons for some years back. In 1825 the people around it suffered excessively, as

they did in other similar places. In 1826, the mill having been burnt, the water was let off, and the shallow part of the pond has been all summer firm dry land, and not a person has been ill in the neighbourhood.

372. The town of Winchester is situated on a remarkably level piece of ground, extending above half a mile between two hills, and upon the hills. Through the middle of the flat, from west to east, runs a stream of lime-stone water. In former years the whole of the flat on both sides of the stream was a marsh. At that time the town was unhealthy, and great numbers of children were sick every summer. Of late years the low places have been gradually filled up. Some of the streets have been paved, the bed of the run enlarged, and the sides for the most part walled up, so that no water is suffered to stagnate in any part of it. From the large spring which is the source of the stream, an abundance of water is conducted by subterraneous pipes to every part of the flat, and to some parts of the high ground, and the streets have so uniform a descent that the waste water from the hydrants has free course to the stream running through the centre of the town. By this means the gutters are easily washed, and this is frequently done.

Much of the ground near the stream, for half a mile west of the town, is still marshy. Along the sides of the rising ground on each side of the stream, and about the spring, are several large dwelling houses.

373. In the excessively hot year 1822 (361), in the hottest part of the summer, the stream which runs through the town was cleaned out and regulated in

the manner abovementioned. While this work was going on, the water was turned into the adjoining street, which is nearly parallel with the general course of the stream. The street was covered from side to side in some parts, but the water was very shallow. Every Saturday evening the water was turned back into the bed of the stream, and again into the street on Monday morning. Thus the street, the bed of the stream, and the mud thrown out on its banks, constituted an abundant source of miasmata. The town was that year sickly, particularly along the stream. In one house on the stream, and near the dirtiest part of the street, there were a number of sick persons, and two died.

374. In 1823 the summer was very wet as before stated (362), and the country sickly ; but the town was very healthy. The streets were kept remarkably clean, the gutters cleaned and washed out frequently, and the weeds in the back streets pulled up and thrown into the middle of the street, where the hot sun and passing wagons soon destroyed them. The marshy ground also above the town was covered with water, and less exposed to the sun.

375. In 1824 the streets were regulated, and the side ways in some places raised so as to render them uniform, and to carry the water regularly onward to the stream. In consequence of this, however, the course of the water was in some places checked, and ponds were formed (253). In the south-west and north-east parts of the town this was particularly the case. In these two quarters there was much more sickness than in the other parts of the town.



376. The year 1825 was unusually sickly in Winchester. The weather was very hot in the former part of the summer, and very dry throughout. The marsh west of the town was just firm enough to bear a light person picking his way through it. There is a mill in the edge of the town on that side, and the water being deficient in quantity, the miller employed a number of men to clean out the race. This was done in mid-summer, and a considerable quantity of water-grass which had obstructed the passage of the water, and of marsh mud, lay exposed to the action of the sun for half a mile along the race. In addition to this, the seine had been several times dragged in a large pond at the head of the marsh, and a great quantity of the same grass drawn to the bank. A gentleman living in one of the houses near the pond, had also had two or three men employed for several days in pulling out the grass, which was so tangled together that a boat was filled in a short time. They carried out and threw on the bank of the pond a great number of boat-loads.

377. That side of the town next to the marsh was the most sickly, but the inhabitants of the houses along the side of the marsh were the greatest sufferers. The inhabitants of one of the houses suffered severely, for some time before those of the others were affected. This house was immediately at the head of the marsh, and directly in line with it and the mud and grass on the side of the race. It was observed by some of the inhabitants that the wind, during the time in which this house suffered alone, blew directly up along the race and over the marsh upon the house.

378. The other houses were situated on the small hills along the edge of the low ground, two or three hundred yards distant from the race, and on the side of it; so that the wind blowing up the stream, carried the miasmata along in front of the houses, but at some distance from them.

The wind changed on a Friday evening, and blew directly across the marsh and the race upon the houses that had hitherto escaped; and a medical gentleman living on the spot, I was informed by the person who gave me some of the most interesting of these particulars, immediately on observing it, predicted that the disease would appear in those houses by Monday morning. On Monday the prediction was verified; and one of those families suffered so severely that they retreated to the town for safety.

379. The spring of 1826 was unusually dry, and excessively hot. The weather was hotter in May than I ever knew it to be. In that month the usual endemic commenced with great violence, and continued through the month of June. In July we had a number of extremely heavy rains, followed by very cool weather. These rains were very partial; one of them, so heavy as to inundate Water-street, did not extend three miles from town. This immediately checked the disease: the weather continues cool and remarkably pleasant, and very healthy.

380. Since the cool weather commenced in July, except some persons who have been out in the neighbouring country on the river, and at similar places, and some who reside in a low, wet quarter of the town, I have had no bad case but in two houses.

One of these was situated within thirty or forty steps of a marshy spot, about thirty yards in length, and half as wide, in such a manner that the south-west wind passed over it into the doors and windows. I had urged the subject on one of my friends in the neighbourhood, predicting evil from its continuance. Of the family exposed, as above mentioned, every white person, three in number, who spent the day at home, were taken sick; one was an obstinate case. Not one of those who spent the day at the shop on the main street had an attack. There was no other dwelling house exposed as this was to the same cause.

In the other instance, a similar spot, twenty or thirty yards square, was situated immediately back of the house to the south-west. The back buildings extend to the west, and face the south; so that effluvia blown from the spot, strike the back buildings on their front, and enter them, or are directed to the principal building. Every white person in this house, consisting of six, except one who was away five or six weeks below the Ridge, was more or less sick; two of the cases were very obstinate.

The back buildings of this house completely protect the house north of it from these exhalations. The family on the south side of it have suffered severely for several years back; not one of them has escaped, and most of them have been very ill, some more than once. This year and the last they escaped, and I have attributed it to their having become habituated, or *seasoned*, to the influence of those exhalations. The other family came to town last year, and were then frequently sick.

381. The city of Baltimore is situated on the north side and the west end of an inlet of the Patapsco, called the Basin. The stream called Jones's Falls flows from north to south through the city, and empties into the Basin. Along the lower part of this stream, particularly on the east side, the land is very flat. To the west, along the side of the Basin, and around its head, the ground is also very flat. At a short distance south of the town flows the Patapsco, separated from the Basin by a narrow slip of high land. The banks of this river are marked with inlets, which are exposed at low water to the action of the sun. A little south-west of the town there are extensive brick-yards, and the land between the city and the river in that direction is flat and inclining to a marshy state. On the eastern side of Jones's Falls, is situated a considerable extent of flat, moist ground, on which stands that part of Baltimore called Fell's Point, which was originally detached from the city. Between the mouth of Jones's Falls and the Point, there was formerly a deep cove, and the adjoining land on the west side of that stream was formerly quite marshy, and intersected by creeks, which are now filled up. Extremely long wharves have been extended into the water; which were generally built with logs, like pens, or log houses, and the enclosed space was filled with chips, shavings, and all kinds of offal, with a thin covering of earth or gravel; and even this was sometimes omitted. Thus whole streets in the flat part of Baltimore, on which a dense population resides, are a mass chiefly of vegetable matter, which of course in the hot weather is in a state of fermentation. Even in winter of-

fensive air sometimes escapes when the outside cover of this mass is broken through.<sup>1</sup>

382. This flat ground along the Basin and Jones's Falls, is very unhealthy. Severe bilious fevers are frequent there; it is the principal seat of the yellow fever, and cases of the latter sometimes occur, when the other parts of the city to the north-west remain quite healthy.<sup>2</sup> The north-western part of the city is high and dry, and very healthy. Dr. Potter, in his excellent Memoir on Contagion, says, "No case of the yellow fever ever did originate in West Baltimore, above Hanover-street, beyond the sphere of the exhalations from the docks, wharves, or made ground. I defy the whole population of the city to produce a solitary exception."<sup>3</sup>

383. In the year 1797 the yellow fever prevailed in the flat parts of the city above described. Previous to the 17th of September the fever had been confined to them, and to those persons who lived in the higher parts who frequented them. On that day a strong south-east wind began to blow, and the fever immediately appeared among the inhabitants of the north-west part of the town. In 1800 several instances of this kind were noted, "and the principle became so familiar that the increment of cases was calculated with tolerable accuracy, by observing the variation of the winds."<sup>3</sup>

384. The cove abovementioned is so situated that all the filth conveyed into it by the west, north-west, and south winds, must remain to stagnate and putrefy.

<sup>1</sup> Medical Recorder, No. 10, p. 215.    <sup>2</sup> Ibid. No. 10, p. 217. 221.

<sup>3</sup> Ibid. No. 4, p. 532. Potter's Memoirs.



“There can be no egress by any but a north-east wind, and this cannot act, for the Point is a barrier which effectually obstructs the wind from that quarter.” In the year 1800, by the prevalence of the north and east winds, which continued a great part of the summer, the bottom of this cove was left bare for some weeks previous to the prevalence of the fever of that year. The disease began on the borders of this cove, and its progress could be traced through the streets in whatever direction the winds blew. The effect was so great on those who were very near, that the labourers employed in filling up its northern shore were compelled to relinquish the work early in the summer (364).<sup>1</sup>

385. The summer of the year 1819 was unusually dry and sultry in Baltimore. The heat was extremely oppressive, not only from its intensity but its duration. August was for the most part clear and hot; and the prevailing winds were from the south and east.

The yellow fever prevailed in the lower part of the city; and along the water two or three miles below town, for several weeks before a single case occurred in town. In the latter it appeared late in July along the docks, and in extremely foul alleys. It made its appearance at the extremity of Fell's Point, in a street running along the water, almost exclusively formed of shavings without even a stratum of earth upon them. Soon after, in consequence of the disagreeable smell arising from this mass of putrefying shavings, complaint was made, and the police ordered it to be co-

<sup>1</sup> Medical Repository, Vol. 4, p. 355. Address of the Medical Faculty to the Mayor of Baltimore.

vered with earth. Three men from a healthy part of the town, were employed to do this; in a few days they were all attacked by the yellow fever and every one died (364. 383).

The disease continued to prevail, and almost every individual who did not leave the affected part of the city, suffered an attack. A violent and long continued storm from the north-east occurred in the latter part of September. The number of cases was increased for a few days, but the weather was rendered cool by it, and the disease gradually subsided after the first of October.<sup>1</sup>

386. The most striking evidence of the truth of the general doctrine is afforded by the occurrences of this summer in Baltimore. At a meeting of the Medical Faculty on the 9th of September, it was unanimously declared, that excepting some cases that had occurred on a wharf, on which there was a very foul alley heavily complained of as a nuisance, that they did not believe a single case had originated west of Jones's Falls. "They likewise declared without a dissenting voice, that four-fifths of the city was at that time *more healthy* than it had been at the same season for several years."

That this should be the case in an elevated dry and gravelly spot, such as the original soil of Baltimore is, is perfectly consistent with the doctrine here advocated.

387. On the Eastern Shore of Maryland, in the year 1793, "after a spring unusually wet, and during a summer as uncommonly hot, the bilious remitting fe-

<sup>1</sup> Medical Recorder, No. 10. p. 214, by J. Revere, M. D.

ver became epidemic." Some of the sick died with the black vomit.<sup>1</sup>

388. The lower part of Dorchester county, Maryland, consists entirely of low land, with a large tract of swamps and marshes. The water in these places usually continues plentiful all summer, but in the summer of 1800 it was nearly all dried up. About the 10th of August a severe epidemic commenced and continued until November. There were some cases of yellow fever. The same fever prevailed also in the following year.<sup>2</sup>

389. Wilmington, in Delaware, is situated on a hill, about one hundred and nine feet above the level of the tide; between two creeks, the Brandywine on the east, and the Christiana on the west; which flow into the Delaware river, distant about a mile and a half in a south-easterly direction. South-east of the town there is a considerable quantity of marshy land; and on the western side of the Christiana there is an extensive marsh, which had been continually inundated until the spring of 1798, when it was drained. From the middle of July in this very hot and dry year, this marsh became extremely offensive; one hundred acres of mud covered with decaying vegetables being exposed to the action of the sun. There were also some very filthy docks in the town. On the northern side of the town there is a small vale in which there are tan-yards, breweries, &c.

390. An intelligent gentleman, who resided in Wilmington during the fall of 1798, informed Dr. Vaughan.

<sup>1</sup> Medical Recorder, No. 4, p. 529. Potter's Memoir.

<sup>2</sup> Medical Repository, Vol. 5, p. 345, by Dr. Mace.

that he observed one morning a fog arise from the marsh below the town, and passing gradually over the creek, settle on the lower part of the town, and branch round into the south-eastern parts, and the vale on the north. "He repeated his observations frequently, and always observed the same phenomena." The course which this fog took, shews very plainly the direction in which the dense gas, arising from the putrefying vegetable matter in the marsh, was drifted; and these very parts were those to which the yellow fever was in that year almost entirely confined.<sup>1</sup>

391. The yellow fever did not prevail in Wilmington in 1793 and 1797. The marshes below the town were about that time very wet and miry. The summers of 1793 and 1797 were rather wet,<sup>2</sup> which state of the weather was unfavourable to the production of miasmata in a wet marsh: but the year 1798 was excessively dry and hot, more so than 1793 or any year since, and therefore was well adapted to produce them in abundance.

392. In Christiana village and its neighbourhood, the disease also occurred in 1798. The first case was in the Welsh-Tract swamps; the second, adjacent to an extensive marsh; three persons in succession died out of one house. In September the disease was general and truly alarming. It appeared in Newcastle, and along the Delaware for some distance.

393. That part of the county of Delaware, in Pennsylvania, which lies on the river Delaware, is very flat and was originally wet marshy land. Though by great

<sup>1</sup> Medical Repository, Vol. 3, p. 368, by Dr. Vaughan.

<sup>2</sup> Rush's Works, Vol. 3, p. 119. Vol. 4, p. 5.

care it has been drained and protected by banks from the water, there are many stagnant pools, creeks, and inlets, abounding with vegetation.

In the year 1823 there were frequent light showers, with very warm weather, and the winds generally from the south and south-west, passing immediately over the marshes below, along the banks of the Delaware. In this year the autumnal fever was very severe.

In the year 1824 the rain frequently fell in torrents, washing off the filth of every kind from the surface of the ground, and overflowing the pools and marshes. The weather was remarkably cool and pleasant, with the wind from north-west.

In consequence of the marshes and pools being entirely inundated, and in July, August, and September, repeatedly washed out, there were very few cases in the low grounds; but in the higher parts of the country the autumnal diseases prevailed.<sup>1</sup>

394. In the autumn of the years 1820 and 1821 the river Schuylkill was "two feet lower than usual, and consequently a large number of logs and stumps, which had long been buried in the river, were exposed, together with much vegetable matter." In the former of these very dry summers, the autumnal epidemic made its appearance along the margin of the river; in the latter, it appeared also at some distance from it.<sup>2</sup>

395. The same disease prevailed along the Susquehannah in 1819. The river was very unusually low. About one-fourth of the stream at one of the ferries, above a sand bar, was entirely stagnant, and the sur-

<sup>1</sup> Medical Recorder, No. 30, p. 217, by R. Dutton, M. D.

<sup>2</sup> Philadelphia Journal, &c. No. 6, p. 356, by W. Harris, M. D.



face was covered with river grass and a green glutinous mass. Of seventy-three persons residing at the ferry and near it, only three escaped sickness.<sup>1</sup>

396. The city of Philadelphia has also suffered severely from pestilence. It has its offensive docks, its foul sewers, its filthy and confined alleys, and low places and ponds in its suburbs. Some idea may be formed of the evil that may spring from these sources, from the following extracts from a paper by Dr. Samuel Jackson.<sup>2</sup>

397. Hodge's dock has been for some years gradually filling up; at low water it is at present uncovered nearly in its whole extent, and a large mass of mud is thus exposed to the action of the sun and air. Two culverts or tunnels discharge their contents into the dock. On the wharf, south of the dock, there formerly stood a large frame building, which had been used for packing and storing hay, of which considerable quantities had fallen into the dock at different times, and when the store was burnt down about two years since, some hundred weight were thrown into the dock.<sup>3</sup>

398. Pegg's run may be considered as an open sewer, passing through the closely built parts of Penn township, Spring Garden, and the Northern Liberties, to the river Delaware. Excepting during heavy rains, or immediately after them, the stream is barely sufficient to carry along, with a sluggish current, the mass of offensive substances that compose it; for in fact it seems more like liquid mud than water. By the erection of a bridge across Pegg's run at New Market-

<sup>1</sup> Philadelphia Journal, &c. No. 6, p. 356, note.

<sup>2</sup> Ibid. No. 2.

<sup>3</sup> Ibid. p. 344.

street, a stagnating pool was formed from two to three hundred feet in length, twelve to fifteen in width, and three in depth.<sup>1</sup>

399. These unquestionably are sources from which proceed pestiferous effluvia; but there are other circumstances in the situation of Philadelphia, which have been too much overlooked in considering the sources of the cause of the epidemics which have afflicted this city. There is on its northern edge a large marshy run, called Gunner's run, separating the village of Kensington from the Northern Liberties; and on the southern border, lies a marshy tract of land, called the Neck, between the rivers Delaware and Schuylkill, and extending from the city to their junction. That exhalations from these have considerable influence over the health of the city is manifest from the following considerations.

400. It appears from a passage in Rush's works, that bilious fevers were for many years confined chiefly to Southwark, which lies next to the marshes below the town. Some physicians mentioning, about the year 1778, the appearance of bilious remittents in the middle and northern parts of the city, Dr. Clarkson, who began to practise in Southwark in 1761, said they had been long familiar to him, and that he had met with them every year since his settlement in Philadelphia.<sup>2</sup> The cause of their more general diffusion appears from a passage in Caldwell's Memoirs. An old and celebrated physician of Philadelphia informed the doctor, that, "previously to the Revolutionary

<sup>1</sup> Philadelphia Journal, &c. No. 2, p. 355.

<sup>2</sup> Rush's Works, Vol. 4, p. 230.

war, the city was surrounded from east to west by a range of forest timber, which protected it from the exhalations discharged by the marshes of the neck, and by the more distant shores of the Schuylkill. This timber fell a sacrifice to the rapacious hands of the British army, in the winter of 1778, since which time the city has been more generally pervaded by bilious fever than had been the case in former years.”<sup>1</sup>

“The yellow fever prevailed in the neighbourhood of Spruce-street wharf, and near a filthy stream of water which flowed through what is now called Dock-street, in the year 1762. Some cases of it appeared likewise in Southwark. It was scarcely known in the north and west parts of the city.” In 1765 an intermitting fever was epidemic in Southwark.<sup>2</sup> In the year 1780 the bilious fever prevailed as an epidemic in Southwark, and in Water and Front streets, south of Market-street.<sup>3</sup> It is remarkable (says Rush,) that Southwark was nearly the exclusive seat, not only of the bilious or break-bone fever of 1780, but of the intermitting fever of 1765 and of the yellow fever of 1805.<sup>4</sup> The yellow fever of 1797 was confined chiefly to the district of Southwark and the village of Kensington for several weeks.<sup>5</sup> It also appeared early in Kensington, in 1798,<sup>6</sup> and in the Northern Liberties, in 1802.<sup>7</sup> Gunner’s run is between these two.

401. On the one hand, we cannot conceive of any thing better calculated to produce disease than the filthy state of Pegg’s run, and of other places in 1820 (397. 398); and the consequence was, a mortal sick-

<sup>1</sup> Caldwell’s Memoirs, p. 38.

<sup>2</sup> Rush’s Works, Vol. 4, p. 230.

<sup>3</sup> Ibid. p. 238.

<sup>4</sup> Ibid. Note.

<sup>5</sup> Ibid. p. 4.

<sup>6</sup> Ibid. p. 40.

<sup>7</sup> Ibid. p. 80.

ness; more so indeed than in 1793, the proportion of deaths being greater. If, however, so great a nuisance within the city produced only one hundred and twenty-five cases,<sup>1</sup> what possible state of things, in that respect, could produce the death of four thousand persons?

402. On the other hand, when we consider the position of the marshes of the neck, south of the city; the great heat of the summers from 1793 to 1799; the prevalence of the south winds in summer, which Dr. Rush says "have blown upon the city of Philadelphia ever since 1793, more constantly than in former years,"<sup>2</sup> and which of course have driven the exhalations directly upon it; in connexion with the fact, that in that part of the town next to the marshes, bilious diseases were common before they were known in the other parts, in which they have made their appearance in consequence of the destruction of a wood which formerly sheltered them; and that it is still, in general, the first, and sometimes exclusively affected by epidemics; the inference is irresistible, that miasmata from this quarter are chiefly instrumental in producing these diseases.

403. This inference is strongly supported by another consideration. Dry weather is most favourable to the production of miasmata from marshes, the sun having thereby a better opportunity of acting on the vegetable matter. In such situations, therefore, the most violent epidemics arise in the hottest and driest summers; and this we shall find, on a comparison

<sup>1</sup> Philadelphia Journal, &c. No. 2, p. 333.

<sup>2</sup> Rush's Works, Vol. 4, p. 113.

of the different epidemics, is what actually occurred in Philadelphia.

404. The following table will serve to show this; as well as the general dependance of yellow fever, on the joint operation of heat and moisture on vegetable matter, or the filth of cities. The account of the temperature is taken from the Medical Recorder;<sup>1</sup> the minutes of rain, from Rush's Works.

	Before the first of August.	After the first of August.	Medium temperature, June, July, August.	Deaths.
1793	Rainy. <sup>a</sup>	Dry, particularly in Sept. and Oct. <sup>b</sup>	82 deg. 2 m.	4,000.
1794	No account, and therefore presumed to be not remarkably wet or dry.	No account, do.	79 deg. 2 m.	A few deaths about dirty places and the ponds of the suburbs. Rush.
1795	Heavy rains in the last of July	and first of August. <sup>c</sup>	79 deg. 2 m.	Some deaths in July, checked by heavy rains which carried away bridges, buildings, &c. Rush.
1796	Rainy. May and June uncommonly wet. <sup>d</sup>	Very dry.	79 deg. 4 m.	Few cases. Rush.
1797	But little rain.	Rainy. <sup>e</sup>	80 deg. 7 m.	1000 or 1100. Rush. 1250. C. Evans.
1798	Very dry. <sup>f</sup>	Dry. <sup>g</sup>	81 deg. 8 m.	3500.
1799	No account.	Very dry. <sup>h</sup>	81 deg.	1000.
1800	Very wet. <sup>i</sup>	Unusual quantity 23th and 30th August. <sup>j</sup>	77 deg.	Some cases confined to one spot. Rush.
1801	Wet in March and April, afterwards very dry. <sup>j</sup>	Considerable quantity on 4th August. <sup>j</sup>	77 deg. 7 m.	Very few cases.
1802	Rather wet. <sup>k</sup>	No account.	77 deg. 2 m.	About 200.
1803	Rather dry. <sup>l</sup>	Little account.	79 deg. 3 m.	Yellow fever slightly.
1804	Rainy. <sup>m</sup>	No account.	74 deg. 7 m.	Uncommonly healthy.
1805	Exceedingly dry. <sup>n</sup>	Very dry. <sup>n</sup>	79 deg. 7 m.	300 or 400.
1806 to 1817	No account.	No account.	75 deg. 7 m. of the whole	During part of the time, unexampled health, especially in the cool summers '14, '15. <sup>o</sup>

<sup>1</sup> No. 1, p. 142, by Cadwallader Evans.

<sup>a</sup> Rush's Works, Vol. 3, p. 119. <sup>b</sup> Ibid. p. 87. <sup>c</sup> Ibid. p. 242. <sup>d</sup> Ibid. p. 243.  
<sup>e</sup> Ibid. Vol. 4, p. 5. <sup>f</sup> Ibid. p. 40. <sup>g</sup> Ibid. p. 44. <sup>h</sup> Ibid. p. 56. <sup>i</sup> Ibid. p. 63. 64.  
<sup>j</sup> Ibid. p. 69. <sup>k</sup> Ibid. p. 78. <sup>l</sup> Ibid. p. 83. <sup>m</sup> Ibid. p. 91. <sup>n</sup> Ibid. p. 95.  
<sup>o</sup> Philadelphia Journal, &c. No. 2, p. 319.



405. These different years may be thus classed.

*First.* The two years 1793 and 1798, in which the greatest mortality occurred, were the hottest.

*Second.* The two years 1797 and 1799, in which the next greatest mortality occurred, were next in temperature.

*Third.* The year 1805 was next in temperature and in mortality.

*Fourth.* The years '94, '95, '96, and 1803, were very nearly alike in temperature, or rather the same : in all these years a few cases occurred, and most in 1803.

*Fifth.* The years 1800, 1801, and 1802, were very nearly alike in temperature, and about two degrees less than the fourth class : and there were very few cases, except in 1802, when a considerable number occurred.

*Sixth.* The year 1804, and the twelve years from 1806 to 1817, were the lowest in temperature, and far the most healthy.

406. In comparing the years of each class together, it will be found that the dryer the year the more violent was the epidemic.

In comparing the epidemics of 1793 and 1798, it will be found that the medium temperature of the months of June, July, and August, of these years, is nearly the same ; that they were alike in dryness after the first of August, but differed materially in the fore part of the summer, the former being before the first of August very wet, and the latter very dry. The epidemic of 1798 was accordingly the most severe. The mortality in 1798 "was nearly as great as it was in 1793, and yet the number of people affected by it

was four times as great in 1793, as it was in 1798; for, in the latter year, the city was deserted by nearly all its inhabitants."<sup>1</sup> There is another circumstance which shows the violence of the epidemic of 1798. On the 29th of September, in that year, there was a frost which so checked the fever in every part of the city, as to induce many people to return from the country,<sup>2</sup> though it afterwards revived. But in 1793 more than half of the whole number of deaths took place after the 29th of September. Nearly all the deaths in 1798 (3,500), took place therefore by the 29th of September; while the number in 1793 was only 1,604 up to that time.<sup>3</sup> The epidemic of 1798 was therefore decidedly the most severe.

407. In comparing the years 1797 and 1799, we find them nearly the same in temperature, and very much alike in the fore part as to rain, but differing after the first of August, very materially; 1797 having been rainy, and 1799 very dry. The epidemic of 1799 was the most severe of the two, the deaths being nearly the same, although "in no year since the prevalence of the fever, was the desertion of the city so general" as in 1799.<sup>4</sup>

408. The same is strikingly exemplified in the fever of 1805. The number of deaths was three or four hundred; very many more, in proportion to the temperature, than occurred in any of the years 1794, '95, '96, and 1803, in which the temperature was very nearly equal to what it was in 1805. But in this year the drought was so great that "the water in the

<sup>1</sup> Rush's Works, Vol. 4, p. 50.      <sup>2</sup> Ibid. p. 45.

<sup>3</sup> Ibid. Vol. 3, p. 97.      <sup>4</sup> Ibid. Vol. 4, p. 57.

Schuylkill was lower by three inches than it had been in the memory of a person of seventy years of age, who had lived constantly in sight of it,"<sup>1</sup> thus in a remarkable manner favouring the action of the sun on the low wet grounds. The fever prevailed chiefly in Southwark (400).

409. In all the years of the fourth class above mentioned, viz. 1794, '95, '96, and 1803, the temperature approached very near to that degree which experience has shown to be accompanied by an epidemic yellow fever; and the diseases also kept pace with it, being of an inflammatory and malignant cast,<sup>2</sup> and in the last year the yellow fever was general, in the city, though it did not affect great numbers.<sup>3</sup> These years were all alike in temperature, and the three former very much alike in moisture, the year 1794 being considered as not remarkable in either respect; in 1795 perhaps less rain had fallen than usual, until the last of July and first of August, when there were very heavy rains; and 1796 was uncommonly wet before August, but very dry afterwards. Alike in heat and moisture, they were also alike in sickness. The year 1803 was rather more sickly; and that year, though like the rest of the class in temperature, was rather dry in the fore part, and not wetter than common in the after part.

410. It thus appears that the temperature being equal, the dryer the summer the more severe the epidemic; obviously because the low wet marshes of the Neck are thereby more exposed to the action of the sun.

411. The same is observed of the West India islands,

<sup>1</sup> Rush's Works, Vol. 4, p. 95.      <sup>2</sup> Ibid. Vol. 3, p. 198. 241. 243.

<sup>3</sup> Ibid. Vol. 4, p. 84. 85. 87.

that a season of drought is a season of severe epidemic disease ;<sup>1</sup> and for the same reason, their towns being all situated near marshes.<sup>2</sup> It was remarked at the time, that the fever of 1798 resembled the yellow fever of the West Indies much more than the fever of 1793, or that of 1797 did.<sup>3</sup>

412. The general correspondence of high temperature with great mortality, is here very striking (404 to 411). In order to explain the few deviations that occur, we must bear in mind the two sources of miasmata abovementioned ; viz. the filth of the city, and the marshes in the neighbourhood, but chiefly in the Neck.

It is evident that a higher temperature, as indicated by the thermometer in the shade, is necessary to produce the evolution of gas from the latter, than from the former ; from a marsh, than from a pavement ; the reverberation of heat from the stones, as well as from the neighbouring walls, making a difference of some degrees ; and therefore that gas will be evolved from occasional sources, when the temperature, as indicated by the thermometer in the shade or within doors, is too low for its evolution from the low grounds around the city, to any great extent.

413. Hence it follows, that whenever occasional sources are suffered to exist, and the temperature is pretty high, sporadic cases will occur, before the low grounds are brought into operation. If the temperature continue to rise so as to produce miasmata from

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 9.

<sup>2</sup> Johnson on Tropical Climates, Vol. 2, p. 188.

<sup>3</sup> Rush's Works, Vol. 4, p. 42.

them, the disease will be general; and as, while it is ascending to the height necessary to produce miasmata from the latter, it will first arrive at that degree sufficient to produce them from the former, the disease always has the appearance of being produced by miasmata from these partial sources. Thus in July of every year, from 1793 to 1799, sporadic cases occurred from occasional collections of filth, &c.; but in several of these years, the temperature rising two or three degrees higher than in the rest, the disease became general. In the first named year, the foul air from a cargo of putrid coffee, produced considerable effect; but that this was totally insufficient to cause the vast mortality that occurred, is evident, when we reflect on the limited extent of the effect of a similar cause in 1802, though so powerful that nearly all the persons affected in that neighbourhood died.<sup>1</sup>

Moreover, the coffee was ordered to be removed about the last of August; but the fever increased very little until the middle of September; and in the unusually hot weather of September, and the first of October, it rapidly increased; and declined immediately on the appearance of frost in the third week of October;<sup>2</sup> showing manifestly its dependance upon the operation of the high temperature, on some more extensive source of miasmata than the coffee.

414. As the sporadic cases must be proportioned in some degree to the magnitude of the sources existing in the city, it may happen that more cases will occur in a season, the medium temperature of which is somewhat less than another, in consequence of there being

<sup>1</sup> Rush's Works, Vol. 4, p. 88.

<sup>2</sup> Ibid. Vol. 3, p. 98.



in the former greater collections of filth. Thus in 1802, the temperature was two degrees lower than in 1803; but in the former year the fever appeared in “a part of the city which had for many weeks before been complained of by many people for emitting a fœtid smell, derived from a great quantity of filthy matters stagnating in that neighbourhood, and from the foul air discharged from a vessel called the *Esperanza*, which lay at Vine-street wharf.”<sup>1</sup>

415. From this it should follow that a general fever can only occur in those years in which the temperature is very high; but a partial fever may occur when the temperature is lower, and will be governed by the circumstances of the spot in which it appears, as well as by the heat. A general fever must be in proportion to the heat and moisture; a partial one sometimes will not be: these views are confirmed by the facts stated in the table.

416. On this ground it is easy to explain the limited extent and the great violence of the fever of 1802; when compared with the general spread and moderation of the symptoms of that of 1803.

In the former, a temperature not sufficient to bring into operation the marshes below the town to any dangerous extent, was yet sufficient within the city (412), in concurrence with extraordinary filth (414), to produce a great effect, but limited in extent by the comparative smallness of the source.

In the latter there was no such occasional source (412); but the temperature approached that degree (the 80th,) which by experience (404) has been found

<sup>1</sup> Rush's Works, Vol. 4, p. 78.

sufficient to bring into operation miasmata from the marshes below. Therefore the disease was general, like the cause ; but moderate, from the temperature not being quite equal to the production, from that source, of a severe disease.

417. Thus every circumstance shows that the epidemics of Philadelphia are to be attributed to miasmata from the marshes below the city. 1st. The part next the marshes originally suffered almost alone (400). 2d. When the trees which sheltered the city were cut down, the disease became more general, but the part next the marshes still suffers most, and first, and sometimes alone (400). 3d. The hotter and dryer the season the more sickness (404, &c.). 4th. In seasons of the same average temperature, the occurrence of heavy rains at the time when the heat is operating with effect lessens it, as in 1795 (table). 5th. During the years in which the epidemics were most destructive, the prevailing winds blew immediately over the marshes (402). 6th. Philadelphia suffers, together with those places which are rendered sickly by miasmata from natural or artificial morasses. Thus, in 1793, she suffered with Alexandria, in the district of Columbia, the neighbourhood of which was then very marshy (337) ; with Caroline forest, on the flat Eastern Shore of Maryland, rendered marshy by an uncommonly wet spring (387) ; and with Harrisburg, Pennsylvania, then having an artificial swamp of great extent adjoining it (149) ; and in 1798 with Wilmington, Delaware, and various parts of that marshy country (389. 392) ; and with New-York, which before that time had comparatively escaped, the fever having ari-

sen from local causes (226. 227), but in 1798 suffered in consequence of the inundation of the lower parts of the city by a rain, which filled the cellars and formed a temporary marsh of Lisenard's meadow (228).

418. It appears then, from a careful examination of all the principal epidemics that have occurred in different parts of the United States for the last thirty-three years, that in every instance there is the clearest evidence of the truth of the doctrine, that the epidemics of this country are caused by miasmata proceeding from vegetable matter on which heat and moisture are co-operating; that the absence of either of the three is sufficient to prevent or put an end to the production of miasmata and their effects; and that the same result proceeds from such an excess of either of the agents, heat and moisture, as prevents the action of the other; excess of heat by evaporating entirely all moisture, or excess of moisture by covering over foul matter, and so preventing the action of heat on it.

419. If we extend our observations to those parts of the continent of America south of the United States, we shall find the same fevers arise in similar circumstances.

420. The whole shore of the Gulf of Mexico is a hot, moist, and unhealthy region. Mosely, giving an account of an invasion of Mexico by the English in the last century, represents the country about the river San Juan, through which the waters of the lake of Nicaragua are discharged into the gulf, as being full of noisome marshes. During the rainy season, which begins about the middle of April, and with uncertain intervals of dry weather ends late in November. there

is a continual succession of heavy rains; and sometimes for weeks together prodigious torrents of water fall, which "from their suddenness and impetuosity, cannot be imagined by an European to portend any thing but a deluge." The weather through this long season of rain is very hot, and at intervals the sun breaks out with scorching heat.

421. "These circumstances are not peculiar to this district, but are common to all the interior parts about Carthagena, Porto Bello, Chagres, the Spanish Main, and the Mosquito shore."<sup>1</sup>

422. The most terrible epidemics prevail all along these shores. The English expedition above alluded to was entirely broken up by sickness, after taking the castle of San Juan. One thousand seamen lost their lives. Of two hundred men, composing the crew of the ship of war which convoyed the transports, eighty-seven were seized and confined to their beds in one night; one hundred and forty-five were buried while in the river, and not more than ten survived the expedition. Of about eighteen hundred people who were sent to occupy different posts, few of the Europeans retained their health above sixteen days, and not more than three hundred and eighty ever returned, and those chiefly in a miserable condition. The survivors, after they left San Juan castle, embarked for Blue-fields, an English settlement about sixty miles north of San Juan river, where most of them died.

A few only of the negroes were ill, "and the remainder of them returned to Jamaica in as good health as they went from it."

<sup>1</sup> Mosely on the Diseases of Tropical Climates, p. 140. 141; also Medical Repository, Vol. 9, p. 178, review of do.

423. Lind gives a similar account of the climate of this region, and says, "Were we to take a survey of the whole coast of the Spanish continent in the bay of Mexico, we should find few seaport towns or rivers, during the rainy season, tolerably healthy."<sup>1</sup>

424. This has been the case from the first discovery of these countries. In 1514 Pedrarias was appointed governor of Darien, and took possession of the country with twelve hundred men. They arrived in the rainy season. The village of Santa Maria was situated in a rich plain, environed with marshes and woods. Of sixteen hundred and fifty men, six hundred died in a month.<sup>2</sup> Such losses as this were common. The greater part of the first expeditions of the European nations to this continent were destroyed by the epidemic diseases.

425. Notwithstanding the extreme unhealthiness of these coasts, the high lands of Mexico are healthy; and the inhabitants are extremely cautious of descending to the seaports in the sickly season. Moseley speaks of the "dry, pleasant, and healthful plains, and agreeable towns of Grenada and Leon, near the lake in the province of Nicaragua."

426. That part of the continent through which the river Orinoko flows is similarly situated. In ascending that river, you sail one hundred miles before the high lands appear. Angostura is situated about three hundred miles up the river. The site is high, and the streets dry. "The soil is a loose earth mixed with pebbles, in some places alluvial, from the overflowings

<sup>1</sup> Lind on Hot Climates, p. 86.

<sup>2</sup> Medical Repository, Vol. 7, p. 319, by N. Webster.



of the river." "The country around was but imperfectly cultivated, is broken with hills and ravines, and covered with a luxuriant growth of tropical vegetation."

427. The United States ship John Adams arrived at this town on the 27th of July, and found the yellow fever prevailing. The thermometer was at that time from 80 to 96 degrees in the day time. The vessel was anchored about twenty paces from the bank. About the first of August the cabin steward, who had been often on shore at market, &c. was taken ill. On the second day of his illness another man was seized. He had been assisting to cut grass, in a place which was a little swampy, and not yet reached by the rising river. The disease spread rapidly, until so many were ill, that all that were well enough were occupied in attending them.<sup>1</sup>

428. The coast of Demerara, Surinam, and Berbice, for several hundred miles, "is so low, that vessels, in running in for the harbours, make the masts of the shipping lying at anchor in the harbours, some time before the land." For thirty miles back, the land rises only thirty feet above the ocean. The soil is so soft, that in wet weather a pole may be thrust down into it four or five feet with great ease.

429. Stabrock, the principal town of Demerara, is situated on the east bank of the river of that name, about a mile and a half from the sea. It is about two feet above the surface of the sea at high water, and at the equinoxes is frequently overflowed. The streets have trenches on each side of them, and there are three or four canals in the town. In these canals all

<sup>1</sup> Philadelphia Journal, &c. No. 7, p. 1, by M. Morgan, M. D.

kinds of filth collect, and the water often stagnates for months together in them. They sometimes clean out these foul canals and trenches, but leave the mass of mud, &c. on the bank, until it becomes hard enough to be taken away by the negroes in lumps.

At low water a great surface of flats is left exposed to the action of the sun.

The rains in this country are commonly very abundant; the temperature very high. In the dry season, diarrhœa, dysentery, remittents and intermittents, and yellow fever, prevail; the latter among strangers at all seasons.

430. In 1803 and 1804 there was a very severe drought, and the crops were very short: vegetables were more scarce than they were ever known to be in the colony. During these two years it was very sickly among the foreigners from high northern latitudes.<sup>1</sup>

431. All the neighbouring colonies, Cayenne, Surinam, Berbice, and Essequibo, resemble Demerara in temperature, excessive moisture, and fatal epidemics. Rush says, "Dr. Gordon informed me that five hundred persons died of the yellow fever in Berbice, between July 1804, and May 1805; during which time there fell not quite three inches of rain."<sup>2</sup>

432. Ferguson mentions the town of New-Amsterdam, in this colony, which is a seaport, and probably the principal town, and the place where the fever mentioned by Dr. Gordon prevailed. It is situated within short musket shot to leeward of a most offensive swamp, in the direct track of a strong trade wind

<sup>1</sup> Medical Repository, Vol. 12, p. 209, by Dr. Frost.

<sup>2</sup> Rush's Works, Vol. 4, p. 111.

that blows night and day, and nevertheless is not in common sickly.<sup>1</sup> It is evident that this marsh is prevented, in common, from producing evil effects, by the excessive quantity of rain which commonly falls in this country. It sometimes rains for weeks and months without cessation; and the ordinary wet season of the summer commences in April and ends in August. And it is likewise evident, that in the remarkable drought abovementioned (431), when not three inches of rain fell from July to May, the marsh was brought into the most favourable state to produce an epidemic.

433. We shall dwell no longer on this region than to observe, that the greater part of Mexico, the Isthmus of Darien, and the bulk of South America lying within the tropics, and being one of the wettest regions in the world, in consequence of the perpetual moist warm wind blowing on them from the sea, are and have ever been exceedingly unhealthy.

434. Many of the neighbouring West India islands are equally sickly with the continent. These islands are remarkable for the almost total destruction of numerous powerful armaments, sent by the different nations of Europe to those countries, in the wars of the last two centuries. Some idea of the mortality, which has in a thousand instances occurred, may be formed from the following passage from Edwards's account of the operations of the English in Hayti in 1793, &c. "Of the 82d regiment no less than 630 became victims to the climate within the short space of ten weeks after their landing. In one of its companies no more than three, rank and file, were fit for duty. Hompesch's

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 13, note.

regiment of hussars was reduced, in little more than two months, from 1000 to 300, and *the 96th perished to a man.*"<sup>1</sup>

435. The medium temperature of all the countries of this part of the globe is much the same, excepting only the variations which arise from the elevation of the land in different places. In the spring, commencing with May, the thermometer varies but little; falling six or eight degrees only immediately after the diurnal rains; 75 degrees may be stated as the medium height. The spring rains are gentle in comparison with the autumnal, and continue about a fortnight, when the weather becomes dry and settled. From the beginning of June until October, "the sky blazes with irresistible fierceness." The thermometer varies but little in the whole twenty-four hours; its medium height near the coast is about 80 degrees; seldom higher than 85 degrees at noon, nor much below 75 degrees at sunrise. In September it occasionally exceeds 90 degrees. It is sometimes so hot in Jamaica, in June and July, that there is no land wind at night. About the beginning of October the autumnal rains commence, and pour down "in cataracts." By an exact account kept at Barbadoes in a year not remarkable for wet weather, sixty-seven inches of water fell.<sup>2</sup>

436. "The principal West India towns, and garrisons for the troops are situated on the leeward shores of the country, at the bottom of the deepest bays that can be found, as a protection to their trade against the

<sup>1</sup> Edwards's History of the West Indies, Vol. 4, p. 225.

<sup>2</sup> Ibid. Vol. 1, p. 7 to 12.

winds from the sea. The soil must consequently be alluvial and is often marshy. Nine-tenths of the towns are enclosed by high hills rising immediately behind them, which exclude the sea breeze, that, in its natural course, ought to reach them from the windward side of the country."<sup>1</sup> "They are all so marshy that in colder latitudes they could not possibly escape agues."<sup>2</sup>

437. The months of August, September, and October, are the sickly months.<sup>3</sup> Until the rains in October, this is the hottest and driest part of the year. Dr. Ferguson says "a year of stunted vegetation, through dry seasons and uncommon drought, is invariably a year of pestilence to the greater part of the West India colonies."<sup>4</sup>

438. This whole statement from different quarters perfectly corresponds with the doctrine here maintained. These islands are very marshy in the neighbourhood of the towns in general (436); the heat is uniformly great, and by the last of the summer excessive (435). This operating for months on the marshes, brings them into a state to produce miasmata in abundance; and with the greatest heat and drought, occurs the most sickness (437). When the heavy rains fall in October, the disease ceases.

439. The doctrine is further confirmed by what occurs in those islands which are uncommonly dry. The latter are by far the most healthy.

The island of Bermuda is elevated, rocky, and dry. There is not perhaps a spring upon it. It is "the

<sup>1</sup> Johnson on Tropical Climates, Vol. 2, p. 188.      <sup>2</sup> Ibid. p. 192.

<sup>3</sup> Edwards's History of the West Indies, Vol. 4, p. 176.

<sup>4</sup> Philadelphia Journal, &c. No. 13, p. 9.



most healthy of all the English possessions in this part of the world.”<sup>1</sup>

St. Christophers is mountainous with some exceedingly rich plains.<sup>2</sup> The air in many parts is pure,<sup>1</sup> a very common expression with Lind for a healthy place.

Two-thirds of Montserat are mountainous and very barren;<sup>2</sup> and the colour of the European inhabitants is a proof of the salubrity of its air.<sup>1</sup>

Nevis is nothing more than a single mountain, rising like a cone in an easy ascent from the sea, only twenty-four miles in circumference;<sup>2</sup> and is as healthy as Montserat.<sup>1</sup>

440. The same is true of Barbadoes. It is the healthiest English colony in that part of the world, except Bermuda;<sup>1</sup> but an uncommonly rainy season seldom failed to produce general sickness.<sup>3</sup>

441. Between Barbadoes and Trinidad there is a striking contrast. In that dry island a wet season is necessary to produce epidemic disease; in the latter, which is a sea of swamp, if it rain less than common, sickness appears. It commonly rains nine months in the year; “if it only rained eight, or if at any time there was a cessation of the preserving rains, the worst kind of remittent fevers were sure to make their appearance.”<sup>3</sup>

442. Havanna is surrounded by extensive meadows and sugar plantations. Two rivers empty into the harbour at the east of the town. This populous city

<sup>1</sup> Lind on Hot Climates, p. 85.

<sup>2</sup> Edwards's History of the West Indies.

<sup>3</sup> Philadelphia Journal, &c. No. 13, p. 8, by Dr. Ferguson.

has many narrow crooked streets, and is very dirty. The yellow fever is a frequent occurrence.

443. Hayti is also a rich island, having an abundance of the richest land, and many streams, and some canals. The yellow fever is a frequent occurrence here also.

444. The large island of Jamaica has a lofty range of mountains running from east to west. At their southern base are vast plains, on which are extensive fields of sugar cane. Rice is cultivated, but not much, the situations favourable to it being very unhealthy.<sup>1</sup> Mosely speaks of the swamps and marshes west of Kingston, and about the ferry, extending their baleful influence to all the neighbouring habitations.

Lind says, "At Jamaica a commodious hospital was erected for the reception of sick seamen, but unfortunately near a marsh. The effects were, that when a patient was sent there with only a mild intermitting fever, it was often changed into a malignant fever, a bloody flux, or some other mortal distemper. The yellow fever often reigned there, attended with the most profuse evacuations of blood, by vomiting, stools, and even by every pore of the skin, when no such symptoms occurred in patients, whose cases had been similar, and who were permitted to remain in their ships."<sup>2</sup> The mortality in this hospital was so great that they were obliged to desert it.

445. Notwithstanding the unhealthiness of this island, there are many healthy places among the mountains, at a distance from the marshes. Mosely says

<sup>1</sup> Edwards's History of the West Indies.

<sup>2</sup> Lind on Hot Climates, p. 131. 132.

some of the mountains at the back of Kingston, and in many other parts of the island, are remarkably healthy. The inhabitants who cultivate the coffee and provision mountains, when they descend to the plains, have the looks of newly arrived Europeans.<sup>1</sup> He also says, "That mountainous air is very healthful in the West Indies, we have many proofs; and that people that have been ill in the low lands, soon recover their health in the mountains."<sup>2</sup>

446. It is unnecessary, as some of these islands will be mentioned again, to go into further particulars here. Suffice it to say, that they are generally marshy (436), and generally sickly in the hottest and driest weather (437); that the dry, rocky islands, as Barbadoes and Bermuda, are healthy in dry (439), and sickly in wet weather (440); and that elevated situations at a distance from marshes are healthy (445).

<sup>1</sup> Medical Repository, Vol. 9, p. 185.

<sup>2</sup> Ibid. p. 184.

## CHAPTER V.

### THE SAME CAUSE PRODUCES THE EPIDEMIC DISEASES OF ASIA, AFRICA, AND EUROPE.

447. WE shall now take a rapid view of the different countries of the Eastern Continent, and show that the epidemics of those quarters of the earth depend upon the same cause. And first of Asia.

448. We have the testimony of Lind, that in all parts of the East, in places situated near large swamps, on the muddy banks of rivers, or the foul shores of the sea, mortal diseases prevail, especially during the rainy season. It is to be observed that the parts he alludes to, are the settlements of Europeans, or the places to which they trade; most of which are seaports, on or near the coast, or on the adjoining islands; and of which nearly every one is within the tropics.

449. The Delta of the Ganges, a part of the province of Bengal, traversed by the numerous mouths of that river, commences two hundred and twenty miles from the sea, or three hundred by the windings of the river, and extends about two hundred miles in width at the lower part. That part next the sea, called the Sunderbunds, is a labyrinth of rivers, so that there is a complete inland navigation throughout and across the lower part of the Delta. This portion of the country, as well as a considerable one north of it, is as flat as

the Delta of Egypt. The rivers continually bring down large quantities of mud and sand, and evidently encroach on the sea. There is not any substance so coarse as gravel in all the Delta, or nearer the sea than four hundred miles. In all the sections of its numerous creeks and rivers, nothing appears but sand and black mould. There is on this rich soil a luxuriance of vegetation almost unknown to any other part of the globe.

450. The rainy season continues from the beginning of June to September and October. By the latter end of July, all the lower parts of Bengal adjacent to the Ganges, are overflowed, the inundation being more than an hundred miles wide. Towards the middle of August the waters begin to subside. It is to be observed that the inundation is not so great near the coast as higher up the river. "The ocean preserves the same level at all seasons, under similar circumstances of tide, and necessarily influences the level of all the waters that communicate with it, unless precipitated in the form of a cataract." "At the point of junction with the sea, the height is the same in both seasons at equal times of the tide." Hence there are many parts not covered entirely as you approach the sea shore.<sup>1</sup>

451. In this rich country, laden with vegetation, soaked with continued rains, and exposed to excessive heat from the perpendicular rays of the sun, fevers and fluxes annually carry off immense numbers in July, August, September, and October.<sup>2</sup>

452. Calcutta, the capital of Bengal, "was built

<sup>1</sup> Rees's Cyclopaedia.

<sup>2</sup> Lind on Hot Climates, p. 61.



literally on a swamp,"<sup>1</sup> with very narrow, confined, and crooked streets, in which were interspersed an incredible number of reservoirs and ponds. During the rapid increase of this town, thousands perished by disease. "Hamilton mentions an instance from his own knowledge of four hundred burials in six months, at a period when all the English resident there did not exceed twelve hundred."<sup>2</sup> Within the last thirty or forty years the streets have been drained and the ponds filled up, and it is since much healthier.

453. "Fourteen miles above Calcutta, at Barrackpore, the position is healthy, but it is owing to the ground being in high cultivation, and cleared and drained all around to a great extent. On the opposite shore of the Hoogly, at Serampore, for the same reason the climate is salubrious. But above all, at Chandernagore, about five miles farther up, on the same west side, the health of Europeans is proverbial; but there the French have taken great pains to drain the grounds; the position chosen for the settlement is elevated above the bed of the water at high tide above fifty feet; and those ditches about which so much was debated in the treaty of peace of 1763, and which the British were so apprehensive of being converted into a military fosse, actually drain off vast bodies of water, for four or five miles from the river. These ditches are admirable evidence of sagacity, and indifference to expense, as the ditches are lined and bottomed with the finest brick, and convey those volumes of water into the main river, which were before suffered to stagnate and infect the air. Chinsurah, two miles

<sup>1</sup> Lind on Hot Climates, p 65.

<sup>2</sup> Rees's Cyclopaedia.

further up, on the same side, is a healthy position, and here great pains were also taken to drain off the rains.”<sup>1</sup>

454. Very similar to this country is the whole coast on the east side of the bay of Bengal. Both Arracan and Pegu have a large river running through them, and entering into the sea in the same way with the Ganges. They overflow their banks; and these countries also are annually inundated. The diseases are the same.<sup>2</sup>

455. On the contrary, on the coasts of Malabar and Coromandel, which are mountainous, and the rivers of which are comparatively small and rapid in their course, the general health is better. Madrass was built close on the margin of the sea, on a sandy desert. It has, however, a river near it, and a moat around it. For the year ending in February, 1778, the mean heat was 81 degrees 4 minutes. In the vicinity, the soil is so dry and sandy that it does not produce a blade of grass spontaneously. Lind says it is the most healthy government belonging to the English, “and in general the air of the whole coast of Coromandel is pure and salubrious, in respect to most other parts of India.”<sup>1</sup>

456. Bombay, in north latitude 18 degrees 58 minutes, is a sterile island on the Malabar coast, seven miles long and very narrow. It had formerly some marshes, and was very unhealthy. These have been drained latterly, and the island has become much healthier than it formerly was. “At Bombay the air is more wholesome than at Bengal; and in general the whole coast of Malabar is tolerably healthy.”<sup>3</sup>

<sup>1</sup> Lind on Hot Climates, p. 65.

<sup>2</sup> Ibid. p. 59.

<sup>3</sup> Ibid. p. 63.

457. Some of the islands off this coast are the most deadly spots on earth. The larger islands, Sumatra, Borneo, Java, and Ceylon, are traversed by high mountains, and have many lakes and ponds which give rise to numerous rivers. Much of the land is low, marshy, and very fertile. In the rainy season they are deluged with water; the heat is always great. The consequence is they are sickly countries, in the rainy season especially.

458. Bencoolen, a seaport in the island of Sumatra, stands upon a morass at the mouth of a river, within four degrees of the line. It is scarcely necessary to add that it is exceedingly unhealthy. The climate has proved more fatal than that of any other British settlement. In 1763, many Chinese merchants with their families settled at this place, but most of them died soon after their arrival. Many English have also fallen a sacrifice; indeed few survived, until they built a fort on *a dry elevated situation*, at the distance of three miles from the town.<sup>1</sup>

There is a place near Indrapour, in this island, where no European can venture to sleep ashore one night during the rainy season, without imminent danger; and at Podang, on the same island, the air has been found so bad that it is commonly called the plague coast. Here a thick pestilential vapour or fog arises after the rains from the marshes, which destroys all the white inhabitants.<sup>2</sup>

459. Batavia is situated on the north coast of the island of Java. The river Jacatra runs through the middle of it. It has a moat around it. Each division

<sup>1</sup> Lind on Hot Climates, p. 60.

<sup>2</sup> Ibid. p. 59.

of the city, on either side of the river, has two canals running lengthwise, and intersected at right angles with cross canals. On the sea side mud banks are continually cast up, so that the citadel, which was originally on the shore, is now more than a quarter of a mile from it. The whole plain on which the city stands bears evident marks of being made ground. The whole country around is a fenny district, abounding with rivulets, by which the circumjacent rice plantations are inundated. On the land side of the city there is a noxious swamp. In short, it stands in the midst of swamps and pools. Situated within a very few degrees of the line, the heat is uniformly great. Sir George Staunton states it to have been as high as 88 to 92 degrees in March.

This city is remarkably unhealthy. There are few examples of strangers remaining long without an attack. Of the Europeans going there to settle, not always one half survive the year. "The unwholesome air of that place alone has cut off more Europeans than have fallen by the sword in all the bloody wars carried on by the Dutch in that part of the world."<sup>1</sup>

460. The island of Ceylon agrees in general character with the rest. It has many rivers, lakes, and canals of considerable extent. In the south-west there is much marshy ground, particularly about Columbo. This place is in 7 degrees north latitude. The black town is skirted by a lake. During the rains, fevers and dysentery prevail.

461. From the observations of Mr. Ives, surgeon of

<sup>1</sup> Lind on Hot Climates, p. 67.

the English naval hospital in the East Indies, made during his return to Europe by land, it appears that in the hot season "intermittent and remittent fevers and dysentery prevail in most parts of the route through Persia, from Gambroon to Aleppo.

462. At Gambroon, a town on the seacoast of Persia, intermitting fevers rage from May to September. At Karec, an island in the Persian Gulf, in the rainy season, intermitting fevers and fluxes are the usual distempers.

463. The country about Bassora, on the river Tigris, is so low that it is only prevented from being inundated by a stone embankment. The Arabs were at that time in the habit of revenging themselves for any injury done them by the Turks of Bassora, by breaking down the banks of the river, and thus laying the country under water. The consequence was a mortal epidemic. On one of these occasions twelve or fourteen thousand of the inhabitants died; and not above two or three of the Europeans settled there escaped with life.

464. At Mossoul, on the river Tigris, in the summer the common diseases were ardent fevers and dysenteries, and intermitting fevers during the wet season. This difference is precisely what has been often observed in this country. The hotter the season the more violent or ardent the fevers; the wetter, the more apt they are to intermit. In 1823, the wettest season known for many years, the intermittent form or type was very common; in the year before, and the subsequent years, which have been dry, the type was remittent, or what has often been called continued fever, and very violent.



465. The party of travellers themselves suffered, in this long journey in summer, in the neighbourhood of the Tigris and the Euphrates, and were continually under the necessity of taking medicine to carry off bile, and keep down a feverish state in which they found themselves.<sup>1</sup>

466. At Aleppo, in Syria, Dr. Russel tells us, in the summer and autumnal season intermittent and remittent fevers and dysentery prevail. The same is true of the neighbouring seacoast, which is swampy, and subject to autumnal fevers.<sup>2</sup>

467. Africa, extending from 37 degrees north latitude to 35 degrees south, affords ample opportunity of observation. The northern states of this continent, from the Atlantic to the Lybian desert on the confines of Egypt, are in the latitude of our southern states. The rivers are small and the whole country is drier.

468. With regard to health, Lind says, "The state of good health commonly enjoyed by the subjects of almost all European nations, who live in a state of slavery in the kingdom of Algiers, Tunis, and Tripoli, and in the empire of Morocco, leaves us no room to doubt of the salubrity of the northern parts of Africa. Even the most southern districts in the empire of Morocco are far from being unhealthy, Europeans there not only living to a great age, but commonly enjoying good health. The healthfulness of that climate clearly appeared from the unimpaired condition and healthful countenances of the late crew of his Majesty's ship *Litchfield*, of 50 guns, who in the year 1758 were ship-

<sup>1</sup> Lind on Hot Climates, p. 77, &c.

<sup>2</sup> Assalini.

wrecked on that coast, and after remaining at Morocco upwards of seventeen months, returned to England in perfect health."

Their seaports are, however, sometimes distressed by the plague, as ours are by the yellow fever.

Here we find heat and dryness attended by health; but the neighbouring country of Egypt affords a strong contrast.

469. Lower Egypt is a rich country, with many lakes and ruinous canals, and so flat, that when the Nile returns to its bed after the annual inundation, many extensive marshes are left around the towns. As soon as the inundation is over, and the sun can operate on the mud, diseases begin to appear and continue all winter, the heat of the country being even then very great, and increase in violence through the summer, until the heat of the sun dries up the whole country, marshes, lakes, and all.

470. Nubia extends along up the Nile, south of Egypt. The valley is in some places only one hundred yards wide; in others, a mile. In this whole course the Nile never overflows its banks. The fields are irrigated by wheels which raise the water from the river; these are so numerous that the revenue is principally derived from them. The climate, though hot in summer, is remarkably healthy.

471. South of Nubia lies the kingdom of Sennaar, an immense plain with numerous branches of the Nile running through it, and interspersed with great lakes. The capital, of the same name, is situated close on the banks of the Nile. The ground on which it stands rises just enough to prevent the river from entering

the town; though it sometimes gets into the houses on the banks, and by softening their clay walls causes them to fall. "The banks of the Nile about the city resemble the pleasantest parts of Holland in the summer time. But soon after, when the rains cease, and the sun exerts his utmost influence, rising to 119 degrees of the thermometer in the shade, the millet begins to ripen, the leaves to turn yellow and rot, the lakes to putrefy and smell and be full of vermin," and "epilepsies, apoplexies, violent fevers, obstinate agues, and lingering painful dysenteries, still more obstinate and mortal" follow.<sup>1</sup> Even the cattle die in these sickly periods. In and near the metropolis, there is a constant mortality among the children; so that the population is only kept up by a constant accession of new inhabitants from the neighbouring countries.

472. By way of contrast observe, that in this extensive plain arise two mountainous districts, both of which enjoy a fine climate and are full of inhabitants; and that the town of Aira, between three and four miles from Sennaar, which has no water near it, and is surrounded by white barren sand, agrees perfectly with all animals.

473. South of this country lies Abyssinia, between 8 and 16 degrees north latitude, generally rugged and mountainous, abounding with forests and morasses, interspersed with many fertile valleys and plains. It has numerous and large rivers, and the lake or sea of Dembea.

The rainy season commences in April, or the beginning of May, and ends about the eighth of Septem-

<sup>1</sup> Rees's Cyclopaedia, from Bruce's travels.

ber. A sickly season follows until the rains begin again about the 20th of October. They continue constant but moderate until the 8th of November, and all epidemic diseases cease with their termination.

474. Here are very remarkable points of difference between this and other tropical countries. They generally become sickly soon after the rains set in<sup>1</sup> (144). Here the sickly season does not begin until they cease. On inquiry, however, into the peculiarities of this country, the difficulty admits of a ready solution. From the elevated situation of the country it is cooler than the tropical regions generally. "On the mountains, and in the higher parts of the country, the sky is clear and serene, the air cool and refreshing, and the people healthy and sprightly." From Mr. Bruce's register, from February 19th, 1770, until May 31st, 1771, a period of upwards of fifteen months, the greatest height of the thermometer appears to have been 91 degrees on the 19th of April; the least  $54\frac{3}{4}$  degrees on the 7th of July. The greatest heat was two degrees less than was experienced in Senegal in December 1763,<sup>2</sup> and less than we often experience in this country in 39 degrees north latitude. During the rains the thermometer fell to  $54\frac{3}{4}$  degrees, a lower temperature than we frequently experience in winter. Hence there was no disease during their continuance. Moisture abounded, but heat was deficient. On the cessation of the rains, the weather becoming hotter, and moisture every where abounding, disease followed. The hottest time, April, was not sickly for want of moisture, the rains not having commenced.

<sup>1</sup> Lind on Hot Climates, p. 47. 49.

<sup>2</sup> Ibid. p. 32.

475. But there is another peculiarity; the latter rains put an end to the epidemic diseases. Differing in temperature from other tropical regions, Abyssinia resembles the north temperate countries also, in having a rainy spell in the last of October or first of November, as we have. If the rains in May, June, and July, reduced the temperature too low for the production of epidemic diseases, it is to be expected that these fall rains should cool the air sufficiently to moderate, and finally to terminate them, as we find it here.

476. On the Red Sea, the port of Massuah, as well as the whole of that coast, from the isthmus of Suez to the straits of Babelmandel, but more especially that part within the tropic, is very unhealthy, and subject to violent fevers, generally terminating in death on the third day.

477. From the straits of Babelmandel to the Cape of Good Hope, little is known respecting the health of the country. It is said to have been the policy of the Portuguese, who have had dominion over the most of this extensive coast, to keep the world in ignorance of every thing concerning it.

The city of Quiloa stands on an island at the mouth of the river Coavo, in south latitude 8 degrees 35 minutes. The houses have each a well watered garden, there being plenty of springs of fresh water. The country about the town is low and fertile in rice, millet, &c. These indications of a wet or marshy country in so warm a climate, would lead us to the belief of its being unhealthy; and Lind states that the Portuguese were compelled to abandon the island.<sup>1</sup>

<sup>1</sup> Lind on Hot Climates, p. 57.



478. He also says that Mosambique is reckoned unhealthy.<sup>1</sup> The soil here also is flat and fertile in rice and millet.<sup>2</sup> Such a soil in such a climate is ever the seat of disease.

479. "The great city and country of Melinda are said to be tolerably healthy."<sup>1</sup> This country is situated between the sea and the mountains called Lupata, where the intervening space is very narrow. These mountains are perpetually covered with snow. There are two small rivers only marked on the map; but so inconsiderable that their names are not mentioned in the account. It is further noted that they are obliged to "import their rice, and that those who are not able to buy, use potatoes, which are here large and plentiful."<sup>2</sup> The situation, the neighbourhood of perpetual snow, the want of rice, which requires a wet soil, and the plenty of fine potatoes, which grow best in a sandy dry soil, all point out a moderate temperature and a dry country.

480. Dr. Lind further states, that the Dutch settlements at the Cape of Good Hope, are fruitful, pleasant, and healthy; and in the Cyclopedia it is stated from Barrow's travels in South Africa, that it is a temperate and wholesome climate.

In this work we are informed, that seven parts in ten of the Cape territory are, for a great part of the year, and some of them at all times, altogether destitute of verdure. The wide sandy plains that connect the hills are thinly strewed over with heath, &c. exhibiting to the eye an uniform and dreary appearance. In the lowest parts of these plains, where the springs

<sup>1</sup> Lind on Hot Climates, p. 57.

<sup>2</sup> Rees's Cyclopedia.

break out, the farm houses are placed, and the patches of cultivated ground contiguous to them, like the oases in the sandy deserts, may be considered as so many verdant islands in the midst of a boundless waste. Such is the belt of land between the first chain of mountains and the seacoast. The soil is a stiff clay, or light sand; a black vegetable mould seldom appears except in garden, orchard, or vineyard ground.

The extensive plains interspersed between the great chains of mountains, exhibit a more dismal appearance than the lower plains. The rains are very unequal, descending in torrents during the cold season, though hardly a shower falls in the hot summer months. The mean temperature during the winter months, according to Kirwan, seems to be from 45 to 55 degrees; seldom exceeding 64 degrees, or falling so low as 34 degrees. In summer the thermometer is generally between 70 and 80 degrees, sometimes between 80 and 90, but scarcely ever exceeds 95 degrees. Within the range of mountains it is yet cooler.

Water is so scarce that the want of it is the principal obstacle to extended cultivation. The torrents of rain that descend for about four months in the year, disappear suddenly in the deep channels that intersect the country; and, in consequence of their rushing with rapidity and violence into the sea, and leaving the deeply sunken beds of the rivers nearly dry, afford no sufficient supply of water for the purposes of irrigation. The periodical rivulets and streams from the mountain springs are absorbed or evaporated, so that in this extensive colony one can scarcely say there is a single navigable river. There is no mention of a marsh in the whole account.

481. The general character of the Cape territory is therefore extreme dryness, particularly in the hot season; and general low temperature, particularly in the summer, in comparison with the same latitude in this country. So that heat and moisture not uniting their influence, and having little vegetable matter to act upon, it is a very healthy country.

482. The different countries on the west coast of Africa, from the territory of the Cape to the great desert north of the river Senegal, lie within the tropics, and agree in general in being sickly during the rainy season, and healthy in the dry. If any are more than usually sickly, it is because they are flat and have large rivers running through them, with marshy banks, or abound with low wet grounds (143. 144. 147).

483. Benguela, in 12 or 13 degrees south latitude, is stated by Lind to be remarkable for a pestiferous air; and in the Cyclopaedia to be so humid, that they have two fruit seasons in the year.

484. The country of Senegal has been the grave of thousands of Europeans. Through it flow the great rivers Senegal and Gambia. "At a distance this extensive coast appears in most places flat, and covered with low suspended clouds." The soil is either marshy or watered with rivers or rivulets, whose swampy and oozy banks are overrun with noxious weeds; the slime and filth on which send forth an intolerable stench, especially towards evening. Fahrenheit's thermometer, in December 1763, the sun being at its greatest distance, stood at 93 degrees.<sup>2</sup>

Notwithstanding this great heat for many months

<sup>1</sup> Lind on Hot Climates, p.31 .

<sup>2</sup> Ibid. p. 32.

in the dry season, most parts of this country are as healthy and pleasant as any in the world.<sup>1</sup> In this season, however, the whole country is parched up; even "the large rivers in the dry season, being confined within narrow bounds, leave a great part of their channel uncovered, which having the moisture totally exhaled, become a solid hard crust:"<sup>2</sup> but soon after the rains begin, a low malignant fever constantly spreads among Europeans.<sup>3</sup>

485. There are some exceptions to this general account. Senegal itself is in some parts sickly, even in the dry season. What parts these are may be learnt from the statement that during the passage of a detachment of soldiers up the Senegal, which took them six weeks, more than one third of their number died; and of the detachment sent in the following year to relieve them, not more than three or four reached the fort alive.<sup>4</sup>

Hence it is evident that those parts which are healthy in the dry season, are so because there is no moisture; but wherever this is to be found, as on the river, the combination of heat and moisture is sure to produce its uniform effect where there is vegetable matter to act upon.

486. Sierra Leone, and some settlements on the Gold coast, are healthier than the country to leeward of them.<sup>4</sup> This coast has a high ridge of mountains running parallel with it, and from the numerous capes, there is reason to believe that the spurs of this ridge run down to the sea, constituting it a hilly country.

<sup>1</sup> Lind on Hot Climates, p. 41.

<sup>2</sup> Ibid. p. 37.

<sup>3</sup> Ibid. p. 30, note, p. 41. 49.

<sup>4</sup> Ibid. p. 39.

From the near neighbourhood of the mountains the rivers must be small, and the water run off speedily. Sierra Leone particularly has its name from being a mountainous country : but all this does not avail when the rainy season arrives ; they suffer, but not so much as the rest.

487. There are exceptions too on the other extreme. Benin, Old and New Calabar, according to Lind,<sup>1</sup> are not even healthy in the dry season. If we examine into the situation of these places, we shall find that the coast of Benin is low and marshy, forming a gulf or bight ;<sup>2</sup> and that the rivers on which these towns are built have “marshy banks, and are much infested by mosquito flies.” Thus we see that health here does not return with the dry season, because the marshes are such that the sun cannot dry them up. Heat, moisture, and vegetable matter, abound throughout the year, and produce a “noxious and pestilential air.”

488. We will now inquire into the state of the islands on the coast of Africa. Most of them, like the neighbouring continent, are sickly. Some of them, as St. Thomas, Princess Island, and Ferdinando Po, abound with streams, marshes, and rice grounds, and, lying under the line, are very unhealthy. Others are very healthy. It is needless to mention all of them ; let it suffice that we mention the principal exceptions to the general rule, and explain them ; we shall find they confirm the general principle.

489. Madeira consists of a succession of lofty hills rising rapidly from the sea. Deep ravines descend from the hills, and though in the hollows of most of

<sup>1</sup> Lind on Hot Climates, p. 34.

<sup>2</sup> Rees's Cyclopaedia.



them there flows a small river, they are in general rapid and shallow. The country is so steep that walls are erected to preserve the soil from being washed away; and the roads will in very few places admit of wheel carriages.

One half the year there is no rain; and although there are numerous streams, the face of the ground does not admit of standing water. Water is so scarce as to be sold. The temperature is remarkably moderate and uniform; the thermometer standing at 60 to 65 degrees in winter, and about 10 degrees higher in summer. This island is uniformly healthy.

490. The Canaries, in north latitude  $27\frac{1}{2}$  to 30 degrees, have long been celebrated for their healthiness. Lind says they are blessed with a temperate, pure, and wholesome air. The soil of these islands is in general light and sandy. They are very mountainous. Tentwelfths of Teneriffe, one of the principal of these islands, consist of rocks, woody and inaccessible mountains, and vineyards. The rivulets flow rapidly to the sea, washing beds thirty feet deep. The air is dry and pure. The variations of the thermometer are from 68 to 82 degrees.

The Grand Canary is high and mountainous, and looks at a distance like a single mountain rising gradually from the circumference to the centre. The fertile districts bear no proportion to the stony, rocky, and barren ground which cover six-sevenths of the whole. The heavens are seldom overcast, but are almost continually serene. No where in the same latitude are the heats so temperate. In consequence of all which it cannot be otherwise than that the inhabitants should enjoy uncommon health and longevity.

491. Let us now take a view of the continent of Europe. Extending from the Frozen Ocean to the Mediterranean sea, there is great variety in the temperature of its different portions, and as great in the state of its surface, with regard to moisture. In the southern parts violent epidemics frequently prevail; and in very hot summers, in the northern parts also.

492. In Spain and Portugal very heavy rains fall in the forepart of the summer; and are generally followed by scorching heat, which burns up the grass, &c. and so dries up the rivers as to render them little more than lines of pools. The southern half of that peninsula lies in the same latitude with the state of Virginia; and the weather, as to rain and scorching heat, with its effects on the fields and rivers, is precisely the same as we experience in this state.

493. In those countries the very same fevers which prevail in this, are experienced in every autumnal season, and are more or less severe according to the temperature which follows the rains. In dry seasons they are particularly severe near the rivers, which have become merely a line of ponds, and in the flat country near them.

494. The English army which traversed Spain and Portugal in 1809, &c. experienced all this. In the very wet and cold month of May, 1809, there were no other diseases in the army than the ordinary ones of the camp. In June, while marching through a singularly dry rocky country of considerable elevation, they were still healthy. The weather had been for some weeks so hot as to dry up the mountain streams, and to leave stagnant pools of water in the ravines which

had been their beds. Some of the regiments bivouaced in these ravines for the sake of being near the water, and several of the men were seized with violent remittent fevers before they could move off the next morning; and "that type of fever, the first that had been seen on the march, continued to affect that portion of the troops exclusively for a considerable time."

495. The same army after the battle of Talavera, retreated into the plains of Estremadura. This province of Spain is divided into three nearly equal parts, by the rivers Guadiana and Tajo. The rivers and all the smaller streams had become mere lines of pools, in consequence of extremely dry weather; which, following the abundant spring rains in May (494), produced in those plains remittent fevers among the natives as well as the English. The latter especially, as is generally the case with the inhabitants of northern countries who travel into southern regions in hot weather, were attacked so violently, that Dr. Ferguson, who had seen much of the yellow fever in the West Indies, declares, that the aggravated cases of the disease differed little or nothing from the worst yellow fever of those islands.

The town of Corea, in this province, is situated on the banks of the Alagon; and has "a pestiferous savannah below the town." It is so sickly that the ecclesiastics had leave of absence from the Pope, of five months in the year, to avoid the fever. In other parts of the province they had leave of absence for different periods. During the autumnal season the epidemic prevailed among all classes, and even infants at the breast were affected.

496. This whole account, it must strike every prac-

tioner in this state, is a perfect picture of Virginia in every dry and hot autumnal season. At this moment (October, 1826,) the same things are fully verified in the low flat plains which were flooded in the spring, and along the course of every river and stream; which are at this time lower than they have ever been known to be.

497. Lower down the river Tajo, about its mouth, the southern side is a low flat country, flooded with water during the rainy season. In the fall of the year, during the extreme drought, it is so sickly that all, who can, fly; and even the king's horses are removed from a hunting residence which he has about a mile from the river, probably in consequence of its having been observed, as it frequently has been in other countries (254), that brutes as well as human beings, are affected by the miasmata abounding in such places.

498. On the other side of the river Tajo is situated the city of Lisbon, on a rocky hilly dry spot, with free open water courses among the hills. Here there is no opportunity for water to stand, but as soon as it falls it runs off. This neighbourhood and city are extremely healthy.

499. The approach to Ciudad Rodrigo, "on the side of Portugal, is through an open hollow country, that has been likened to the dried-up bed of an extensive lake." In very dry weather following the rainy season, during which this low land was inundated, remittent fevers of the same malignant grade with those before mentioned prevailed among the English troops' (495).

\* 494 to 499, is taken from Ferguson's paper, Philadelphia Journal, &c. No. 13.

500. In the year 1800 the rains in the spring continued a month longer than usual, and the moisture was excessive. The thermometer rose to 95 degrees, a degree of heat unusual in Spain. "In the rays of the sun, and in damp places, the mercury often rose to 112 degrees." This year was very sickly, and the yellow fever prevailed in many seaport towns.<sup>1</sup>

501. In the years 1801 and 1803, the yellow fever prevailed in many towns of Spain. In the very hot year 1804, a mortal epidemic prevailed throughout many of the southern provinces, particularly on the shores of the Mediterranean. In 1805 the summer was uniformly pleasant and cool in the south of Spain, and the common bilious remittent and intermittent fevers were scarcely seen in any part of the country.<sup>2</sup>

Lind states that in the months of September and October, 1764, when it had been excessively hot and dry for many months, violent epidemic bilious disorders resembling those of the West Indies, prevailed at Cadiz.<sup>3</sup>

502. These diseases also prevail in France. Senac, an able writer of that country, says, "There is scarcely any one who has not experienced something of intermitting fever. This disease spares neither childhood, manhood, nor old age." He says they more generally prevail in autumn, and persons living in the vicinity of marshes are particularly subject to them. They rage, for example, in the northern part of France.<sup>4</sup> He mentions an instance, which has already been

<sup>1</sup> Medical Repository, Vol. 11, p. 133.      <sup>2</sup> Ibid. Vol. 9. p. 381.

<sup>3</sup> Lind on Hot Climates, p. 91.

<sup>4</sup> Caldwell's translation of Senac on Fevers, p. 18. 19. 20.



stated (154), of a mortal epidemic from a pond near a city, which was gradually filled up with all kinds of filth, and produced the fever as soon as the bottom became exposed to the action of the sun.

503. "In the year 1694 a fever broke out at Rochfort, in France, which, on account of the malignant symptoms and great mortality, was at first believed to be the true plague. But M. Chirac, who was sent by the court to inquire into its nature, found the cause to arise from some marshes that had been made by an inundation of the sea, and observed that the corrupted steams, which smelled like gunpowder, were carried to the town by the wind that had blown long from that quarter. About two-thirds of those who were taken ill died. This fever raged in June, July, and August, and then ended upon a great fall of rain which purified the air and refreshed the stagnant water."<sup>1</sup>

504. The excessively marshy country of Holland has been the seat of the most terrible epidemics. Pringle says, that the flat part of Flanders is marshy and unhealthy, but the higher parts are dry and healthy. "Great part of the united provinces with Dutch Brabant, from Grave downward along the Maes, being likewise low and wet, is subject to the same distempers with the flat part of Flanders. But the air is worst in Zealand; as that province is not only low and watery, but surrounded with the oozy beaches of the eastern and western Scheld, and the most marshy parts of the country, so that almost every wind, except from the sea, adds to its native moist and un-

<sup>1</sup> Pringle on Diseases of the Army, p. 323.

wholesome exhalations.”<sup>1</sup> “But at Ostend, which is situated upon the ocean, and where there are no marshy grounds very near, the inhabitants are in general healthy.”<sup>2</sup> “The sickness never begins until the heats have continued long enough to give time for the putrefaction and evaporation of the water. The epidemics of this country may therefore be generally dated from the end of July or beginning of August, under the canicular heats; their sensible decline, about the first falling of the leaf, and their end when the frosts begin.”<sup>3</sup> “It is to be remembered that the summers are hotter on the continent than in Britain; and that in the Netherlands the heats are more stifling than in hilly countries.”<sup>4</sup>

505. On the plain of Deighern, a dry, open, and elevated piece of ground, “reputed the most healthful for a camp in the Netherlands,” the army lay a month in 1745; and “after a month’s stay moved to Vilvorde, where the soil being still dry, the country airy, and the weather temperate, the men continued so very healthy that in the middle of September few battalions returned above twelve sick.”<sup>5</sup> On making a small move to form a line along the great canal, the effects were immediately seen; and on returning to the former camp they soon disappeared.<sup>6</sup> Five battalions marched out of Ostend, so healthy that they left only ten sick; but being conducted to Mons, whilst the town was surrounded by an inundation, the autumnal diseases prevailed so much that in three weeks two hundred and fifty were taken ill and left behind when

<sup>1</sup> Pringle on the Diseases of the Army, p. 2.      <sup>2</sup> Ibid. p. 3.

<sup>3</sup> Ibid. p. 5.      <sup>4</sup> Ibid. p. 6. See more to the same amount in Pringle, p. 11 to 14.      <sup>5</sup> Ibid. p. 35.      <sup>6</sup> Ibid. p. 36.

the rest set out for Brussels. Another regiment was put into the citadel at Antwerp. The air of that city is moist; the fort in particular is exposed to exhalations from the adjacent marshes. In the beginning of October the sick of this battalion amounted to one hundred and sixty-three. In the town fluxes, intermittents, and remittents, were common among the inhabitants.<sup>1</sup>

505. In 1747 four battalions in South Beveland and the island of Walcheren, in Zealand, the lowest and most marshy part of the country, "were so very sickly that at the height of the epidemic some of these corps had but one hundred men fit for duty, which was less than a seventh part of a complete battalion. The Royal in particular, at the end of the campaign, had but four men that had never been ill." "The epidemic fever, by reason of the great heats of the season, not only began more early in Zealand than usual, but was more severe, and fully as fatal to the natives as to us."<sup>2</sup>

506. In 1748, "though the sickness was general, those who were near the marshes suffered by far the most, both in number and violence of the symptoms. The Greys cantoned at Vucht, a village surrounded with meadows, either then under water, or but lately drained, were the most sickly." "At the end of the campaign they had but thirty men who had not been ill." Two other corps, which also lay near the inundation, were also very sickly; and a regiment of foot at Niculand, where the meadows had been floated all winter and were but just drained, returned sometimes

<sup>1</sup> Pringle on the Diseases of the Army, p. 37.

<sup>2</sup> Ibid. p. 57.

above half their number ; and the Scotch fuzileers, lying farther from the inundation, but in a low moist village, had above three hundred ill at one time. It was remarkable that a regiment of dragoons, cantoned at a village half a league from the marshes, on a situation somewhat higher than the rest, on an open heath, with the winds blowing mostly from the dry grounds, were in a good measure exempt from the distress of their neighbours, having remitting and intermitting fevers of a more favourable kind, and in a much smaller number.<sup>1</sup>

507. The peasants were great sufferers, particularly those near Breda and Bois-le-duc. "This country had not known such distress for a number of years, as two such causes had not concurred ; I mean the inundations, with a hot and close summer and autumn."<sup>2</sup>

"This remitting fever attended every campaign, and was most frequent and fatal after the hot summers of the years 1743 and 1747 ; but in the campaigns of 1744 and 1745, the seasons being temperate, fewer were seized and the cases were milder."<sup>3</sup>

508. Holland has ever been thus unhealthy. In 1669 an epidemic fever carried off two-thirds of the principal inhabitants of Leyden. The situation of this city is low and damp. The latter part of the summer and the autumn were unusually hot, dry, and calm.<sup>4</sup>

Forestus says the city of Delft, where he practised, was scarce ten years together free from the plague,

<sup>1</sup> Pringle on the Diseases of the Army, p. 65.

<sup>2</sup> Ibid. p. 67.

<sup>3</sup> Ibid. p. 172.

<sup>4</sup> Ibid. p. 190.

or some pestilential distemper.<sup>1</sup> This city is built on the banks of a river, and is traversed by several canals.

In later times, in 1810, an English army was almost annihilated at Walcheren, in Zealand.

509. Immediately south of Holland lies the mountainous country of Switzerland, one of the healthiest countries in Europe. The contrast between Holland and Switzerland is as great in point of health as in the face of the country.

510. At the foot of the mountains of Switzerland lies the celebrated country of Italy. It is traversed by the Appenine mountains, which, touching the coast around the gulf of Genoa, make thence a curve towards the Adriatic, but again approaching the Mediterranean, terminate at Cape Lucca. A little east of the city of Naples, a branch of the Appenine extends into Calabria, and terminates at its southern extremity. This range of mountains divides the peninsula lengthwise, in such a manner that there is but a narrow strip of land between it and the Adriatic, and no considerable river empties into that sea, nor is any lake mentioned as lying on that side of the mountain. This country, I believe, has scarce ever been mentioned as the seat of an epidemic.

511. On the other side lies a comparatively wide tract of country, in the curve of the mountains, with a southwestern exposure. In this district are many lakes, some with marshy banks. Through it flow the rivers Arno, Tiber, &c. Eustace, in his Classical Tour, says that the Arno, near Florence, presents to the eye in summer little more than a few pools united by a

<sup>1</sup> Pringle on the Diseases of the Army, p. 323.



narrow rill (492). The ground around Pisa is flat and wet, with a stream running through it. Formerly another vented its waters at the same place, but now its mouth is ten miles off; the old channel is still to be traced. From Pisa to Leghorn, a distance of thirteen miles, the country is a dead plain, with a piece of water on the left of the road, and intersected particularly near Leghorn by numberless canals, cut to let off stagnant waters. Before this was done it was very sickly; and even now is dangerous in heat of summer.<sup>1</sup>

512. The whole Campagna di Roma is a flat country; so much so as to require very large drains and abundance of ditching to make it dry enough for cultivation. "The seacoast, even at the distance of four or five miles, is bordered with a wood of ilex, and various shrubs,"<sup>2</sup> &c. "In this forest are several large shallow pools,"<sup>3</sup> &c. "The pools or lakes line the coast,"<sup>4</sup> &c. "The flat and swampy tract spreads from these lakes to the foot of the Volscian mountains, and covers an extent of eight miles in breadth and thirty in length, with mud and infection."<sup>4</sup>

513. From this state of things it is manifest that in July, August, and September, fevers must be common, and that an extraordinarily dry and hot season must be extraordinarily sickly. Accordingly we find this has always been the case. Livy speaks of a terrible epidemic in a season of extraordinary drought, and mentions that the country people were first affected, and finally the citizens of Rome. The city is distant but twelve miles from the seacoast, and the prevailing winds blow

<sup>1</sup> Eustace's *Clas. Tour*, Vol. 2, p. 290. 292. <sup>2</sup> *Ibid.* Vol. 1, p. 445.

<sup>3</sup> *Ibid.* p. 446.

<sup>4</sup> *Ibid.* 452.

directly on it over the marshes, which, from the above account (512), occupy almost the whole interval.

514. Pringle says before the Romans knew how to let off the water standing around the city, it was exceedingly sickly; but when drains and sewers were made it became more healthy, and only the lower and wetter places of Latium remained sickly. When the city fell into the hands of the Goths, the drains being stopped, and the aqueducts cut, the Roman territory became one continued marsh, which for a series of years occasioned incredible desolation. And though these evils have since been remedied, yet by neglecting to draw off the water after inundations of the Tiber, when great heats succeed them, malignant remitting and intermitting fevers are general and fatal.<sup>1</sup>

515. A considerable part of the country between the Mediterranean and the Appenines is broken and hilly. The epidemics affect the inhabitants of this high land as well as those of the marshy plains, though not in the same degree. This circumstance has given rise to disputes on the subject of the origin of the disease,<sup>2</sup> and it has too hastily been admitted, that an elevated, dry district, can emit miasmata.<sup>3</sup> There appears, however, to be no difficulty in accounting for the existence of epidemic fever throughout the whole tract of country between the sea and the mountains before-mentioned.

516. The prevailing winds in Italy, in summer, are south and southwest. The marshes are on the southwestern side of the country; they are very extensive,

<sup>1</sup> Pringle on the Diseases of the Army, p. 192.

<sup>2</sup> Philadelphia Journal, &c. No. 18, p. 282. <sup>3</sup> Ibid. No. 16, p. 389.

and of course emit a very great quantity of miasmata in hot weather. Considering the situation of the marshes with respect to the hilly part of the country, and the fact that the prevalent winds blow directly over the marshes upon it, it could not be otherwise than that the miasmata should be carried thither and produce fevers. It is precisely what has often been observed, and must always occur when high ground is to leeward of a marsh (165).

517. Very exaggerated statements have been made respecting the depopulation of Rome by the continual encroachments of the malaria. Rome, however, is like other cities similarly situated. Lancisi, in his account of the epidemic of 1695, declares, that the fever was limited to those parts of the city which were built on made ground, and that the hills were exempted from the disease.<sup>1</sup> Dr. Clarke, an English physician, who has lived some years in Rome, states, that except in certain places, the disease is not gaining ground in extent or violence. In 1819 there were one-fourth less patients admitted into the hospital of San Spirito than in 1818.<sup>2</sup>

518. Naples is a healthy city in comparison with Rome. The wind in Italy is generally south at noon, and then declines to the east or west, but most frequently to the latter, and becomes sometimes due west. None of these winds blow from the marshy tract towards Naples; generally they blow directly from the city to the marshy country, thus protecting the former from the miasmata. The city is situated at the bot-

<sup>1</sup> Potter's Memoir, Medical Recorder, No. 4, p. 520.

<sup>2</sup> Philadelphia Journal, &c. No. 18, p. 284.

tom of a large bay, three-parts surrounded by woods and mountains, on ground rising liking an amphitheatre from the sea.

519. The country between the foot of the Alps and the mouth of the Po is a vast plain. From Novara to Turin, situated at the confluence of the Doria with the Po, Eustace says he passed four rivers, the country a dead flat, intersected by canals and planted with rice. This rich and moist country was formerly the seat of epidemic fevers; its cities are frequently mentioned as having been ravaged by pestilence. Near the Po, says Eustace, is a little church dedicated to St. Laurence, "*quia flumen pestemque repulit.*"<sup>1</sup> An epidemic is mentioned by Pringle as having followed an inundation of that river in the spring, which "left marshes, and these corrupting infected the air throughout the summer."<sup>2</sup> This country, since it has been drained and cultivated with great care, is more healthy, and we do not at this time hear of the pestilences which formerly almost depopulated Vincenza, Verona, Padua, &c.

520. In hot summers the cities of Italy are distressed by the same fevers which prevail in our cities in similar seasons. The yellow fever prevailed in Leghorn several years in the beginning of this century, particularly in the very hot year 1804,<sup>3</sup> when so many towns of Spain on the Mediterranean coast were ravaged. The city of Leghorn is situated in a very flat country (511), and is traversed by a great number of canals.

<sup>1</sup> Because he repelled the river and *the pestilence*. Eustace's Tour, Vol. 2, p. 294.

<sup>2</sup> Pringle on the Diseases of the Army, p. 322.

<sup>3</sup> Medical Repository, Vol. 8, p. 425.

521. In some parts of the north of Europe autumnal fevers are very fatal in hot summers. Hungary has been a fatal country to multitudes of men contending for the possession of the strong towns on the Danube and the Drave. About these rivers the country is low and marshy, and sickly. The other parts are said to be dry and healthy.<sup>1</sup>

Copenhagen is situated in a low and moist place, and has frequently been ravaged by epidemic fevers. In 1652 the summer was unusually hot and dry, and a destructive fever prevailed in the city.<sup>2</sup>

522. There are some very large islands belonging to this quarter of the world. The most remarkable of these is the island of Great Britain. The northern part of the island being very mountainous and cool, is not much affected with autumnal fevers; but the southern is rich and productive, in many places wet and marshy, and autumnal fevers, intermitting and remitting, prevail very generally. The marshy counties of Lincolnshire and Essex are noted for intermittents, and sometimes very violent remittent fevers prevail in the south of England. Lind gives a short account of a violent fever in 1765 in Portsea and the neighbourhood.

523. Portsea is a low damp island on the south coast of England, between Portsmouth and Langston harbours. The town of Portsmouth, on this island, has near it wide and deep ditches for defence; it is separated from the town of Portsea by a creek, and there are other creeks in its neighbourhood. Here the ague frequently prevails, and sometimes the flux, during the autumnal season.

<sup>1</sup> Pringle on the Diseases of the Army, p. 188, note. <sup>2</sup> Ibid. p. 189.



524. The year 1765 was remarkably dry and hot. In August the thermometer often rose to 82 degrees in the middle of the day. This heat spread the fever, increased its violence, and in many places changed its form. At Portsmouth, and throughout almost the whole island of Portsea, an alarming continual or remitting fever raged. Some marines were seized on board the guardships in the harbour near the mud, but a greater number on duty at Portsmouth. The marines who exercised thrice a week near a morass, suffered much. Half a dozen at a time were frequently taken ill in the ranks. This violent fever prevailed in this year in many other parts of the island.<sup>1</sup> This may suffice at present for the fevers of this island. The subject will be more fully discussed hereafter.

525. Sardinia is so sickly an island that the Romans used to banish criminals to it as a punishment; the population is thin at this day.

The interior of the island is extremely marshy, and the air very hot. It is "annually visited with an epidemical sickness which rages from June to September. In some summers there is a want of rain for four or five months, and then it is that this sickness exerts its utmost violence."<sup>2</sup>

526. The island of Minorca is rough and uneven, with low marshy valleys between the hills, and there are some pools of standing water. In the moist fenny places the inhabitants plant quantities of cane. Near Port Mahon there is a lake which in summer is almost dry, and a slimy putrescent mass is left on the bottom, from which pestiferous effluvia incessantly

<sup>1</sup> Lind on Hot Climates, p. 15. 16. 17.

<sup>2</sup> Ibid. p. 21.

arise.<sup>1</sup> The rains are very abundant in the forepart of the year, and from June until September and October it is excessively hot.

Towards the end of June the young children are attacked with cholera, and in the following month tertian fevers of various forms affect all ages, increasing until the autumnal equinox, when they rage with the utmost fury, and afterwards gradually decline at the approach of winter.<sup>2</sup>

527. In the temperate summers of 1744 and 1745 tertians and dysenteries were not so numerous, or so severe, as in the hot summers 1746, 1747, and 1748. In 1746 the summer was hot and wet; July was unusually hot. Tertians were very severe in July and August; but September being very cool, they abated sooner than common. In 1747 May was rainy and uncommonly hot. "The extraordinary heat of May ushered in the summer diseases somewhat sooner than usual." In July and August, 1748, the weather was excessively sultry, and it was very sickly.<sup>2</sup>

528. The climate of Sicily is remarkably mild and pleasant, excepting in the latter part of the summer, and the autumnal season. In the heat of summer, the neighbourhood of stagnant waters is very dangerous, and the effects of the miasmata are seen on the countenances of those who live near them. "As soon as the sun enters the Lion, this country becomes the house of death; fevers, of the most malignant kind, seize upon the imprudent or unfortunate wretch that spends a night near them (ponds and marshes); and

<sup>1</sup> Johnson on Tropical Climates, Vol. 2, p. 103.

<sup>2</sup> Cleghorne's account of the weather and diseases of Minorca.

few escape with life, when attacked by so violent a disorder."<sup>1</sup>

529. One of the principal cities of this island, Syracuse, is famous for the destruction of invading armies by autumnal fevers. This city has a harbour of considerable extent. The river Anapus empties into it, after flowing through an extensive marshy plain. In the immediate neighbourhood of the city, extending from the head of the great harbour, are the vast Lysimelian marshes, half covered with water in the vernal months. In the excessively sultry summers of this climate, nothing less could be expected than the destruction of a body of men exposed to the miasmata which arise in such places.

530. When the Athenians besieged Syracuse they were encamped on the marshy ground adjoining, and the army was some time employed, in that hot season, in building a wall across the plain and the marshes of the Anapus to inclose the city. Thus situated, in the autumnal season the army was attacked, and finally forced to retreat, by a fever which killed a multitude of the soldiers.

531. After this the Carthagenians invaded Sicily with an army of more than 300,000 men. The general, Imilcon, "pitched his tent in the very temple of Jupiter, then standing at Olympia; and his army encamped around him." This spot, the little suburb of Olympia, was surrounded by the vast marshes above mentioned. In this situation, "an eminence between two morasses, highly favourable for a camp, and for

<sup>1</sup> Med. Rep. Vol. 2, p. 368, from Swinburne's Travels, Vol. 2, § 49, Dublin edition.

rendering it impregnable," he continued a month in the midst of summer, and the heat was that year excessive. While here, his army was attacked by an enemy he lost sight of in his care to guard against the attacks of those whom he was besieging. "Violent dysenteries, raging fevers, burning entrails, and acute pains in every part of the body," with raging madness, were the symptoms of the terrible disease which drove him to the necessity of purchasing leave to retreat, leaving unburied the carcasses of half his army.<sup>1</sup>

532. When the Romans under Marcellus besieged Syracuse, the Carthagenians under Himilco went to its assistance. Marcellus, with one division of his army, occupied a camp on the east of the city, and immediately after seized on Epipolæ, an elevated part of the town thinly inhabited and of considerable extent. The other division, under Crispinus, was stationed at the ancient camp at Olympia. The Carthagenians encamped on the great harbour, in company with a body of Sicilians.

533. In the autumnal season a fever appeared among the Romans at Olympia, and the Carthagenians and their allies on the harbour. These two spots we have seen are much exposed to miasmata (529.531). When the disease was found to be very severe, the Sicilians withdrew into the neighbouring cities; Marcellus, observing how fast the disorder increased, drew his troops into that part of the city which he occupied; "but the Carthagenians, admitted into no city, together with their generals, Himilco and Hippocrates, totally perished."<sup>2</sup>

<sup>1</sup> Medical Repository, Vol. 2, p. 374.

<sup>2</sup> Ibid. p. 377.

534. Thus it appears that in every region of the earth the epidemics of hot weather are produced by miasmata arising during the putrefaction of vegetable matter. Some objections, however, have lately been advanced against this old doctrine, with such appearance of strength as to induce some to waver in their belief.<sup>1</sup> These objections, it is due to the importance of the subject to examine.

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 1, No. 16, p. 365.



## CHAPTER VI.

### ANSWER TO SOME OBJECTIONS.

535. In a paper read before the Royal Society of Edinburgh, Dr. Ferguson has controverted the doctrine advocated in the preceding pages with much apparent strength. On a close examination of the cases he has stated, it will nevertheless appear, that they all support the doctrine he opposes.

536. Dr. Ferguson asserts that "the marsh must cease to be a marsh in the common acceptation of the word, and the sensible putrefaction of water or vegetables must alike be impossible before its surface can become deleterious;" and infers from a narrative of facts, going in his opinion to support this assertion, "that putrefaction, under any sensible or discoverable form, is *not* essential to the production of pestiferous miasmata."<sup>1</sup>

537. The facts may be arranged under the two following heads: 1. "That it (the marsh poison,) is never found in savannahs or plains that have been flooded in the rainy season, till their surface has been thoroughly exsiccated, vegetation burnt up, and its putrefaction rendered as impossible as the putrefaction of an Egyptian mummy."<sup>2</sup> 2. "That it is found most virulent and abundant on the driest surfaces; often where vegetation never existed, nor could exist for

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 2.      <sup>2</sup> Ibid. p. 13.

the torrents, such as the deep and steep ravines of a dried water course.”<sup>1</sup>

538. In support of the first he makes the following statements. “The first time that I saw endemic fever, under the intermittent and remittent forms, become epidemic in an army, was in the year 1794, when, after a very hot and dry summer, our troops, in the month of August, took up the encampments of Rosendaal and Oosterhout, in South Holland. The soil in both places was a level plain of sand, with a perfectly dry surface, where no vegetation existed, or *could* exist, but stunted heath plants: on digging it was universally found to be percolated with water to within a few inches of the surface, which, so far from being at all putrid, was perfectly potable in all the wells of the camp.”<sup>2</sup>

The army in 1799 “remained the whole autumnal season in the most pestiferous portion of that unhealthy country, without suffering in any remarkable degree from the endemic fever;” but “the preceding summer had been wet and cold to an unexampled degree; during the whole of the service we had constant rains, and the whole country was one continuous swamp, being nearly flooded with water.”

“In the year 1810, a British army at Walcheren, on a soil as similar as possible, and certainly not more pestiferous, but under the different circumstances of a hot and dry preceding summer, instead of a wet and cold one, suffered from the endemic fever of the country to a degree that was nearly unprecedented in the annals of warfare.”<sup>3</sup>

<sup>1</sup> Philad. Journal, &c. No. 13, p. 13.    <sup>2</sup> Ibid. p. 2.    <sup>3</sup> Ibid. p. 3.

539. These and some other cases are admitted to be facts ; but what do they prove ? Nothing more than that the pestiferous gas is found in these places after the surface has been flooded and has become dry ; *not* that it is *never* found in savannahs or plains that have been flooded, *until their surface has been thoroughly exsiccated, vegetation burnt up, and its putrefaction as impossible as that of a mummy.* There is a profusion of evidence to the contrary. Lind, speaking of Senegal, says, “ This, as most tropical countries, has, properly speaking, only two seasons, the wet and the dry ; the former is only of about four months continuance, and is *the season of sickness,*”<sup>1</sup> &c.

“ No sooner the rains fall, than this long parched crust of earth and clay (forming the bottom of the dried-up rivers,) gradually softens, and the ground, which before had not the least smell, begins to emit a stench, which in *four or five weeks*, becomes exceedingly noisome. *At this time* the sickness is generally most violent,”<sup>2</sup> viz. three months *before the end* of the rainy season, which lasts four months.

“ But the diseases most fatal to Europeans are fluxes and fevers. The latter make their appearance *in* the rainy season.”<sup>3</sup>

“ *Soon after the rainy season began*, a low malignant fever constantly spread itself among the Europeans.”<sup>5</sup>

“ The most mortal epidemic, however, is that low malignant fever of the remitting kind, which rages *only in* the rainy season.”<sup>4</sup>

<sup>1</sup> Lind on Hot Climates, p. 32.      <sup>2</sup> Ibid. p. 37.

<sup>3</sup> Ibid. p. 41.

<sup>4</sup> Ibid. p. 42.

“The season of their appearance is *during* the rains, and for some short time after they have ceased.”<sup>1</sup>

“On the 18th of May it rained the whole day; and the rain continued, with but short intervals, until the beginning of October. In the month of *June* almost two-thirds of the white people were taken ill.” “Its attack was commonly in the night, and the patients, being then delirious, were apt to run into the open air. I observed them frequently recover their senses for a short time, by means of the heavy rain which at that time fell upon their naked bodies.”<sup>2</sup> “Of these not one was taken ill till after the rains *began*.”<sup>3</sup>

Some idea may be formed of the thorough soaking of this whole country, for the whole time of the sickly season, from the following passages. “The quantity of rain which falls during the wet season is almost incredible. By observations made at Senegal, 115 inches depth of rain were found to fall in these four months; a quantity equal to that which falls in England during the space of four years.”<sup>4</sup> “We were, as I have already observed, thirty miles distant from the sea, in a country altogether uncultivated, *overflowed with water*, surrounded with thick impenetrable woods, and overrun with slime.”<sup>5</sup>

540. Nor is this at all variant from our own experience. Not to multiply instances, it is fresh in our recollection, that, in the year 1823, more sickly by far than any other for nineteen years back, the plains of this country were so far from being exsiccated that the roads were often miry, and that they were kept continually wet by repeated rains. Two cases men-

<sup>1</sup> Lind on Hot Climates, p. 47.      <sup>2</sup> Ibid. p. 49.

<sup>3</sup> Ibid. p. 50.

<sup>4</sup> Ibid. p. 33.

<sup>5</sup> Ibid. p. 51.

tioned already are strongly in point (150. 330). As long as the old pond in the former continued *wet*, the family was sickly; but as soon as it was *thoroughly dried*, they became healthy amidst surrounding sickness. So also in the latter, as soon as the bottom of the pond was *quite dry*, sickness was at an end. In short, the result of my observation for twenty-three years is, that if there be much rain in summer, (where vegetation abounds,) sickness soon after commences; if the weather be hot and dry, the disease continues until the country be perfectly dry, when the new cases become less frequent and it becomes more healthy, except in spots, viz. *the places still wet, not the parts exsiccated*.

541. Pringle speaking of the low countries says, "The country bordering on the lower part of the Maes is not only unhealthful on this account, but by reason of floods from the smaller rivers, lies all the winter under water, and continues *damp throughout the summer*. The moisture and corruption of the air were much increased by the inundations which had been made about the fortified towns since the commencement of the war, and sensibly became more noxious on letting off *part of the water*, in the beginning of summer, after the preliminary articles of peace were signed. For these grounds, which were once entirely covered, being *now half drained and marshy*, filled the air with moist and putrid exhalations."<sup>1</sup>

"This sickness was much greater near Breda and Bois-le-Duc than at Eindhoven, which lay at a much greater distance from the *inundations and other marshy grounds*."<sup>1</sup>

<sup>1</sup> Pringle on Diseases of the Army, p. 62.



“Those who lay farther from the water and were only annoyed with the natural moisture of the country and the heat of the season, had both fewer and milder fevers.”

Thus, though the sickness was general, those who were near the marshes suffered by far the most both in number and violence of the symptoms. The Greys cantoned at Vucht, a village within a league of Boisle-Duc, surrounded with meadows, either *then under water* or *but lately drained*, were the most sickly. Roth's and Rich's dragoons, who also lay near the inundations, were likewise very sickly. Johnson's regiment of foot at Nieuland, where the meadows had been floated all winter and were *but just drained*, returned sometimes above half their number.<sup>1</sup>

This is more than sufficient to show the incorrectness of the position (537), that the malaria “is never found in savannahs or plains that have been flooded in the rainy season, till their surface has been thoroughly exsiccated,” &c.

542. In support of the second position (537), “that the malaria is found most virulent and abundant on the driest surfaces, often where vegetation never existed, or *could* exist,” he makes the following statement, and others as striking.

“The beautiful post of Prince Rupert's, in the island of Dominica, is a peninsula which comprehends two hills of a remarkable form, joined to the main land by a flat and very marshy square isthmus to windward, of about three quarters of a mile in extent. The two hills jut right out on the same line into the sea, by

<sup>1</sup> Pringle on the Diseases of the Army, p. 65.

which they are on three sides encompassed. The inner hill of a slender pyramidal form, rises from a narrow base nearly perpendicular, above and across the marsh, from sea to sea, to the height of four hundred feet, so as completely to shut it out from the post. The outer hill is a round-backed bluff promontory, which breaks off abruptly in the manner of a precipice above the sea. Between the two hills runs a very narrow clean valley, where all the establishments of the garrison were originally placed; the whole space within the peninsula being the driest, the cleanest, and the healthiest surface conceivable. It was speedily found that the barracks in the valley were very unhealthy, and to remedy this fault, advantage was taken of a recess or platform near the top of the inner hill, to construct a barrack, which was completely concealed by the crest of the hill from the view of the marsh on the outside, and at least three hundred feet above it; but it proved to be pestiferous beyond belief, and infinitely more dangerous than the quarters in the valley within half musket shot below. In fact no white man could possibly live there, and it was obliged to be abandoned. At the time this was going on, it was discovered, that a quarter which had been built on the outer hill, on nearly the same line of elevation, and exactly five hundred yards farther removed from the swamp, was perfectly healthy, not a single case of fever having occurred on it from the time it was built. These facts were so curious, that I procured the surveyor-general of the island to measure the elevations and distances, and I have given them here from his report.”<sup>1</sup>

<sup>1</sup> Ferguson's Essay, Philadelphia Journal, &c. No. 13, p. 10.

543. These statements are admitted to be true ; but they only prove that the “ malaria ” was found *in those places*. They do not prove the general position, that the driest places are those in which we find it most virulent and abundant. On the contrary, the multitude of instances already stated show the reverse, and an instance directly opposed to it in point of fact is mentioned by Dr. Ferguson in the very case above recited (542), on which he rests, in part, as proof of his assertion. If the gas is so virulent and abundant on one hill, it is not to be found on the other ; and it is found on that hill nearest the marsh.

544. It is clear then that all that is established, and that is not denied, is that the malaria was found on those particular spots mentioned ; or, that it is sometimes found on dry plains after they have been flooded, and on dry hills. Had not these cases been brought forward, the inference we have drawn (178) would have rested unquestioned on the multitude of facts of a directly opposite character that have been stated, as well as on those which must occur to every one from his own reading and experience. These cases can only be considered then, as long as they continue unexplained, at the most, in the light of exceptions to the general rule ; and should we be able to show that putrefying vegetable matter existed on the spot, or near enough to produce the effects observed, the cases are no longer exceptions—they confirm the general rule.

545. This we shall now show to have been the fact in every instance mentioned, and first of those which occurred in Holland (538).

Pringle, speaking of this country, has the following

observations.<sup>1</sup> “Great part of the United Provinces, with Dutch Brabant, from Grave downward along the Maes, being likewise low and wet, is subject to the same distempers with the flat part of Flanders. But the air is worst in Zealand, as that province is not only low and watery, but surrounded with the oozy beaches of the eastern and western Scheld, and the most marshy parts of the country; so that almost every wind, except from the sea, adds to its native moist and unwholesome exhalations.

All this tract of the Netherlands being little higher than the level of the sea, or the rivers that pass through it, was once so much exposed to inundations from floods and high tides, that till dykes and drains were made, it was one large morass; and even now, after incredible labour, the country is liable to be overflowed by extraordinary floods and other casual inlets of water.”

Speaking of two villages, the one ten, the other fourteen feet above the subterranean water, he mentions it as an extraordinary height in that country.<sup>2</sup>

Here is cause enough on our ground. Here decomposition of vegetable matter takes place to a very great extent; and the mere fact that the army was encamped on a naked plain of sand, is no argument against its sufferings being produced by a gas arising during the process of putrefaction, in a country where there are no hills to intercept the passage of miasmata, and where marshes to produce them so abound, that, as Pringle says, almost every wind adds to its native moist and unwholesome exhalations. The more per-

<sup>1</sup> Pringle on the Diseases of the Army, p. 2.

<sup>2</sup> Ibid. p. 63.

fect the dryness of the spot, the more fatal the disease ; because the same intense heat that rendered it so, operates at the same time on the surrounding marshes, mud, &c.

546. The justice of this explanation may be tested by referring to the Bahama islands. They are low and flat like Holland ; and “seem to have been formed, if external appearances may be trusted, from an accumulation of shells or small calcarious grains of sand.”<sup>1</sup> But the soil is remarkably thin, and they have no rivers depositing mud and forming morasses. They are also, in perfect accordance with the doctrine supported in these pages, remarkable for health ; whereas, “if paucity of water, where it has previously and recently abounded,”<sup>2</sup> be the cause of epidemics “in climates of high temperature,” here we ought to find them as frequent and violent as in Holland ; indeed, more so, as the heat is so much greater, and the rains so very abundant (435).

547. The occurrence of sickness in Holland in 1810 (538), is explained in the same way ; and the exemption in 1799 is perfectly consistent with our doctrine, the superabundance of water which made “the whole country one continuous swamp,” and the unexampled coolness being both calculated to prevent putrefaction to any great extent.

548. The next case mentioned occurred in Portugal. “In June the army advanced again towards Spain, in a healthy condition, during very hot weather. The army was still healthy, certainly without

<sup>1</sup> Edwards’s Hist. West. Indies, Vol. 4, appendix by M’Kennan.

<sup>2</sup> Ferguson, p. 16.



endemic fever, and marching through a singularly dry rocky country, of considerable elevation, on the confines of Portugal. The weather had been so hot for several weeks as to dry up the mountain streams ; and in some of the hilly ravines, that had lately been water courses, several regiments took up their bivouac, for the sake of being near the stagnant pools of water that were still left amongst the rocks. The staff officers who had served in the Mediterranean, pointed out the dangerous nature of such an encampment ; but as its immediate site, amongst dry rocks, appeared to be quite unexceptionable, and the pools of water in the neighbourhood perfectly pure, it was not changed. Several of the men were seized with violent remittent fever before they could move from the bivouac the following morning ; and that type of fever, the first that had been seen on the march, continued to affect that portion of the troops exclusively for a considerable time. Till then it had always been believed amongst us, that vegetable putrefaction (the humid decay of vegetables,) was essential to the production of pestiferous miasmata ; but, in the instance of the half-dried ravine before us, from the stony bed of which (as soil never could lie for the torrents,) the very existence even of vegetation was impossible, it proved as pestiferous as the bed of a fen. The army advanced to Talavera through a very dry country, and in the hottest weather fought that celebrated battle which was followed by a retreat into the plains of Estremadura, along the course of the Guadiana river, at a time when the country was so arid and dry, for want of rain, that the Guadiana itself, and all the smaller streams, had,

in fact, *ceased to be streams*, and were no more than *lines of detached pools* in the courses that had formerly been rivers; and there they suffered from remittent fevers of such destructive malignity, that the enemy and all Europe believed that the British host was extirpated.”<sup>1</sup>

549. This case certainly operates against Dr. Ferguson’s doctrine. May was very wet, and the weather in the following months was very hot, and the country had become very dry. During this time the army marched through a part of Portugal and Spain, and, except a small part of it which encamped in the “half-dried ravine,” which was the bed of a stream, continued free from fever until they were forced to retreat into the plains of Estremadura, along the course of the Guadiana, when that river and its branches had become mere lines of detached pools, and “*there* they suffered from remittent fevers of such destructive malignity,” &c.

550. This is precisely what occurs with us. When for want of rain the country is burnt up, as happened in 1822, and almost in as great a degree in 1825, and again in the present year, 1826, it is generally healthy. Few cases of fever occur except near ponds, marshes, and the streams which have become *mere lines of pools*; and it is observed that the cases in such situations are extremely severe (364 to 366. 370. 511).

551. If “one only condition be indispensable to the production of the marsh poison, on all surfaces capable of absorption,” viz. “*paucity* of water, where it has previously and recently *abounded*,” if it be found

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 4.

only in plains that have been flooded in the rainy season, after their surface has been thoroughly exsiccated; why was the army healthy on their march until they arrived on the banks of the Guadiana, a line of pools? and why was that part of the army alone affected during their march, which encamped in the bed of a stream which had also become a line of pools? Why are autumnal fevers general in wet years, amidst continued rains which never allow the surface to dry? (362. 539. 540); and why in the dry years is the sickness confined to the wet places near rivers, &c.? (363 to 366).

552. The bare hilly country near Lisbon, where the foundation of the soil, and of the beds of the streams is rock, with free open water courses among the hills, is a very healthy one; but the Alentejo land, on the other side of the Tagus, though as dry superficially, being perfectly flat and sandy, is as much the reverse as it is possible to conceive. The breadth of the river, which at Lisbon does not exceed two miles, is all that separates the healthy from the unhealthy region; and the villages or hamlets that have been placed along the southern bank of the Tagus, for the sake of navigation, are most pestiferous abodes. The sickly tract, however, is not confined to the immediate shore of the river. Salvaterra, for example, about a mile inland, is a large village and royal hunting residence in the Alentejo, which is always reputed to be very healthy till the beginning of the autumnal season, when every person, who has the means of making his escape, flies the place. In their superstitious fear, the inhabitants declare, that even the horses and other

animals would be seized with fever if left behind, and therefore they always remove the royal stud. The country around is perfectly open, though very low, and flooded with water during the whole of the rainy season ; but at the time of the periodical sickness, it is always most distressingly dry, and exactly in proportion to the previous drought, and consequent dryness of soil, is the quantum of sickness.”<sup>1</sup>

553. The nature of the country about Lisbon is precisely such as would lead to the conclusion that it is a healthy country, if health depend on the absence of putrefying vegetable matter. Though water abounds in the spring, it cannot stand in pools. But if paucity of water following abundance be the only indispensable condition of the production of disease, why is not this country as sickly as the equally elevated and rocky neighbourhood of Port of Spain, mentioned by Dr. Ferguson in the same essay, or the hill at Prince Rupert’s (542).

554. With respect to the Alentejo land, there is certainly nothing peculiar in its circumstances. It is a flat low country, lying between two rivers, near their mouths, having several cross cuts from one to the other, and to the sea, and abounding with moisture in the forepart of the summer. It is evident that a large village and a royal hunting residence implies a plenty of vegetation in the proper time for it, and although very arid at the time the sickness takes place, there is no reason for believing that the malaria arises at the season of the year when vegetation is actually burnt up. On the contrary, in the progress of vege-

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 5.

tation to perfect dryness, decomposition must take place as the heat of the weather increases, and it is manifest that gases must be produced. Moreover, in such situations there always is much filth and vegetable matter about the banks of the rivers, and more or less of marshy ground, the exhalations from which must have free access to every part of so flat a spot as this is.

555. The same may be said respecting the country around Ciudad Rodrigo. "It is situated on a rocky bank of the river Agueda, a remarkably clear stream; but the approach to it on the side of Portugal is through a bare, open, hollow country, that has been likened to the dried-up bed of an extensive lake; and upon more than one occasion, when this low land, after having been flooded in the rainy season, had become as dry as a brick ground, with the vegetation utterly burned up, there arose fevers to our troops, which for malignity of type could only be matched by those before mentioned on the Guadiana"<sup>1</sup> (548). The gases which are produced during the progress of vegetation to perfect dryness, rest on this flat hollow country, and gently glide down to the beds of the rivers, the lowest places, on one of which the city is situated.

556. The same was experienced at Corea, a town on the banks of the river Alagon, "with this addition clearly demonstrated, that no spot of the pestiferous savannah below the town, was so much to be dreaded as the immediate shores of the river."

To this the same explanation may be given. If ever

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 6.



decomposition of vegetable matter take place, it must occur in a flat country, with abundant rains in the spring, followed by excessive heat, and "the pestiferous savannah below the town" was a most suitable place for the evolution of miasmata.

557. In the case of the post at Prince Rupert's, it is evident that the inner hill and the clean valley could not have been the surface which produced the cause of the fever; because, almost universally, such "heights of the purest soil" are healthy, as in Barbadoes, and other islands of the West Indies (439. 440), and at Lisbon (552); and because at this very post, the outer hill, separated only by a small valley from the inner, and manifestly as well adapted to the production of the cause of autumnal fever, was entirely free from it. It is evident that we must look to some other quarter for the source of the evil.

558. In order to discover this, we must recal to mind that the pestiferous gas is dense, resting in the lowest places, and driving with the wind (178). With regard to the latter property, independently of its being a necessary consequence of its nature, as a dense gas, the evidence afforded in the statements respecting the fever on Fort Hill, and in Back-street, Boston (223. 224); Cliff-street, New-York (229); and at the cantonment of the United States troops at Gallio-polis, Ohio (163), leaves no room for doubt.

559. In the case now under consideration there was a large marsh, three-quarters of a mile in extent, to the windward of the hill. The gas generated in this marsh must necessarily have been driven up the ascent of the hill next to it, or the inner hill, by the trade-

wind which sets continually in that direction, and surmounting its shoulders, fell from its density into the valley between the two hills; down which, being protected by the inner hill from the wind, it quietly glided into the sea, and did not reach the outer hill five hundred yards further removed from the marsh.

Thus it was that the valley was found unhealthy; that the removal to the elevated position on the inner hill, only carried the men to a place in which the gas was more abundant than in the valley; because, after passing the shoulders of the hill, though its density would dispose it to descend to the lowest part, it must, by the impulse given it by the wind, be somewhat more mixed with the common air between the hills; and that the outer hill was quite healthy because protected from the gas by the interposition of the valley, and by its distance.

560. "Port of Spain, Trinidad, the capital of the island, is situated very near the great eastern marsh, with which it is in direct communication, by a marginal line of swamp along the seashore. It cannot be called a healthy town, but it is very far from being uninhabitable. On the right are some covering heights, which rise out of the marsh at one extremity. These, unlike the site of the town, which has been built on marshy or alluvial ground, are composed of the purest and most healthy materials, (pure limestone, the purest and the best in all the West Indies,) yet have they proved a residence deadly and destructive in the greatest degree to all who venture to inhabit any part of their diversified surface. No place, however elevated, or sunk, or sheltered, or walled in, gives security

against the exhalations from below; only it has been distinctly ascertained, that these prevail with more or less malignity, exactly in proportion to the elevation of the dwelling. The lower, consequently nearer the marsh, the better. The tops of the ridges are uninhabitable. On the highest top, at an elevation of four hundred feet, and farther removed from the marsh than the town itself, a large martello tower was built to defend the place. It possessed a fine temperature, but proved so dangerous a quarter that it was obliged to be abandoned. Not even a Creole mulatto Spaniard could sleep in it with impunity for a single night, after a course of dry weather.”<sup>1</sup>

561. Dr. Ferguson has said nothing of the direction of the trade-wind in relation to “the great eastern marsh,” the town, and the hills. Taking, however, Tanner’s new and excellent map for a guide, the town is situated in the northwest corner of the island. On the left the coast runs a little east of south; on the right directly west, forming a cape running out from the main body of the island to a considerable distance. The covering heights to the right, mentioned by Dr. Ferguson, are on this neck of land. They rise out of the great eastern marsh, which is of course to windward.

Thus situated, the gas from the marsh is blown directly along up the ascent of these heights, and over them to the sea.

562. The effect of wind blowing miasmata up a hill, was strikingly exemplified in 1798 at Fort Hill, Boston, and on the Blue Ridge, in Virginia, in 1823, &c.

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 10.

(558. 165). A remarkable instance is also stated in the Medical Repository of New-York.<sup>1</sup> Brewton-Hill, two miles below Savannah, in Georgia, has ever been a dangerous place of residence in the summer and fall. "The house is on the edge of a lofty hill, perhaps fifty feet above the level of the river, distant a third or half a mile, and the intermediate space is a rice-field. It has no protection, and the forms of disease are in the most concentrated and active state."

563. It is manifest, that if the troops at Gallipolis (163) had been cantoned on high ground, ascending gradually from the pond to the camp, that the gas would just as certainly have been forced along up it, and must have produced the same effect as it actually did on the level ground. And it is as evident, that, in this way, the gas ascended the sloping heights at Fort Hill; those of the Blue Ridge, in Virginia; of Prince Rupert's, and of Port of Spain.

564. This is illustrated and confirmed by what was observed at English harbour, in Antigua. A range of fortified hills surrounded the dock-yard. Monk's hill *rises perpendicularly above the marshes* to the height of six hundred feet. The ridge is about one hundred feet lower, and *slopes backwards from the swamps*.

The men who stood guard in the night among the marshes below Monk's hill, were frequently seized with furious delirium, and died in a few days. Not a single case of fever of any kind occurred to those inhabitants of Monk's hill *who were not obliged to sleep out or stand guard below*.<sup>2</sup> At the ridge, three hun-

<sup>1</sup> Vol. 10, p. 360, note.

<sup>2</sup> See the same in Lind on Hot Climates, p. 149.

dred feet above the marshes, the artillery soldiers (seventeen in number,) never were on any of the night guards, but *every man* suffered an attack of the ordinary remittent. At the barrack on the top of the ridge, at the height of five hundred feet, and still farther retired from the marshes, there scarcely occurred any fever worth notice. Those on the perpendicular hill escaped, while those on the hill sloping backwards from the swamp, suffered. It is evident that, in the former case, the perpendicular form of the hill prevented the ascent of the gas, which must have been driven around the base; whereas, in the latter, the gradual slope of the hill facilitated the ascent.<sup>1</sup>

565. "The leeward shore of Guadaloupe, for a course of nearly thirty miles, under the shelter of a very high steep ridge of volcanic mountains, never felt the sea-breeze, nor any breeze but the *nightly land wind* from the mountains; and though the soil, which I have often examined, is a remarkably open, dry, and pure one, being mostly sand and gravel, altogether and positively without marsh in the most dangerous places, it is inconceivably pestiferous throughout the whole tract, and in no spot more so than the bare sandy beach near the high water mark. The coloured people alone ever venture to inhabit it, and when they see strangers tarrying on the shore after night-fall, they never fail to warn them of their danger. The same remark holds good in regard to the greater part of the leeward coast of Martinique,"<sup>2</sup> &c.

566. The name Guadaloupe is given to two islands

<sup>1</sup> See Johnson, Vol. 2, p. 113, for similar instances.

<sup>2</sup> Philadelphia Journal, &c. No. 13, p. 19.



having a very narrow channel of sea water between them. The leeward island is called Basse-terre, (or low-land,) from being very low and marshy ; the other, called Grand-terre, has also large marshes, as may be gathered from Dr. Ferguson's account of the situation of Point au Pitre, situated on the leeward shore of Grand-terre.

Although then the soil be open, dry, and pure, mostly sand and gravel, it differs little in this respect from most of the West India islands. Most of them are light and open, and have, notwithstanding, pestiferous marshes. In a space of thirty miles of low land, with rivers and marshes, in a hot country, decomposition of vegetable matter, in abundance, must take place. Sheltered from the trade-wind which would carry it off, the gas produced on its surface must abound ; and it is not wonderful it should be "inconceivably pestiferous throughout the whole tract ;" nor that the *night land wind*, from the mountains to the shore, should carry it down to the latter, and render it particularly dangerous to remain on shore through the night.

The same remark holds good of the leeward coast of Martinique, this island having also its basse-terre.<sup>1</sup>

567. The facts stated, (545 to 566), therefore, only show that "malaria" is found in certain places where vegetation has been burnt up, or does not exist ; but its existence there has been shown, in every instance, to be consistent with the origin and nature of the gas laid down in the preceding pages, and the presence of a source of it, sufficient to produce the effects ob-

<sup>1</sup> Lind on Hot Climates, p. 85.

served, pointed out : and therefore the conclusion that putrefaction is not essential to the existence of "malaria," is so far from being legitimately drawn from them, that they confirm the opposite doctrine.

568. To support the doctrine that putrefaction is not essential to the production of pestiferous miasmata, Dr. Ferguson endeavours to show that where vegetable putrefaction is self-evident, "it is not productive of disease and death similar to what emanates from the marsh poison."

He alleges that in West India sugar ships, where the drainings of the sugar mixing with the bilge water of the hold, creates a stench that is absolutely suffocating to those unaccustomed to it, fevers are never known to be generated.<sup>1</sup> To this assertion we cannot, it is true, at this distance reply, by adducing a case or cases of these effects proceeding from the putrefaction of that precise kind of vegetable matter ; but we have stated cases at large, in which there is the most unquestionable evidence that vegetable matter of other kinds in a state of decomposition, on ship-board, does produce such effects (168 to 175). We have further shown that a mass of matter, similar to that which forms a marsh, in a pile in a city, produces the same effects (340). We have shown that a mass of vegetable matter, on a larger scale, but equally circumscribed, in a state of decomposition, produced corresponding effects. The fever in the cantonment at Galliopolis manifestly proceeded from the gas arising from the pond ; the troops having escaped entirely until the wind blew directly over it,

<sup>1</sup> Philadelphia Journal, No. 13, p. 14.

and in five days after that occurrence one half the soldiers being sick. This pond was partly filled with fallen trees ; and at the time of the raging of the fever, contained “a great quantity of muddy water, with a thick slimy moisture of putrefying vegetables” (163).

569. With great confidence of support, he refers to the effect of dung heaps in every part of the world. Heaps of dung, literally, have in this country very little vegetable matter in them. But we have frequently read accounts of families being destroyed almost entirely by fevers, which were by the physicians attributed to a decaying hay-stack, or some such object near the house. The following facts occurred in my own family.

In the fall of 1821, when the season was uncommonly healthy in Warrenton, Fauquier county, my family was unusually sickly. Few escaped entirely ; two were quite sick. This excited some surprise until we adverted to the following circumstance. The garden had just been inclosed ; the land was not rich, and about two hundred cart loads of manure were put on about one-third of an acre. The weather after July was excessively dry, and the pumpkin vines, &c. which were very luxuriant, died. These dead vines, an exuberant crop of weeds, &c. were piled against the fence to rot for manure. The pile, eighteen feet long, five feet high, and projecting about three feet from the fence, was about fifty feet southwest of the back door.

570. The same thing, it is highly probable, occurs very much oftener than people are aware of in the fall of the year, and is passed over without notice *because*

*every body is sick*; a reason we have often heard given by unthinking people, for not believing a marshy situation unhealthy. A family near the house of a friend of mine, fed a number of large hogs in a small yard before the house with a profusion of cut grass; the filthiness of the yard was such, that it was difficult to get to the house. Of this family in that fall three men died with the worst symptoms, as hemorrhages, &c. It is true that they lived near a stream of water; but it was large, the banks were dry, and this family suffered much more than their neighbours in the village.

571. With the same view (568) the doctor endeavours to show, that where vegetable putrefaction abounds there is little or no sickness. "Thus at the town of Point au Pitre, Guadaloupe, which is situated amidst some of the most putrid marshes in the world, the stench of which is almost never absent from the streets, the place was far from being *uniformly unhealthy*. Strangers, however much they might be annoyed by the smell, *often* resorted to it with impunity. No more was its first outpost Fort Louis, where the waters are so stagnant and putrid, that it is even more offensive than at Point au Pitre; but at fort Fleur'D'Epee, the farthest outpost, at the extremity of the marshes, where they approach to the state of terra firma, where little or no water is to be seen on the surface, and no smell exists, there cannot be supposed a more deadly quarter, and all white troops consider their being sent there as an equivalent to a sentence of death. It ought to be noted that the marshes of all these three posts are overgrown with the thickest underwoods, and rankest aquatic vegetation of every kind."

572. "A fact of the same kind has been observed in the island of Tobago. The principal fort and barrack of the colony has been placed immediately to leeward of the Barcolette swamp, within the distance of less than half a mile, and the strong ammoniacal stench of its exhalations, even at that distance, often pollutes the barracks; but these are so far from producing fever *at all times*, that when I visited the white garrison there, they had been more remarkably exempt from *that form of disease* for several years than any other troops in the West Indies."<sup>1</sup>

573. Of the same cast is the account of "the town of New-Amsterdam, Berbice, situated within short musket shot to leeward of a most offensive swamp, in the direct tract of a strong trade-wind that blows night and day, and frequently pollutes even the sleeping apartments of the inhabitants with the stench of the marshes, yet it had produced *no endemic fever worthy of notice*, even amongst the newly arrived, for a period of months and years previously to my visiting that colony."

574. With regard to the stench, it is well known that when vegetable matter is designedly placed in circumstances favourable to decomposition, and when this is rapidly going on, as in a mass of bruised apples, or peaches, in the process of making brandy, or in a beer tub, there is little or no smell. On the contrary, in consequence of the fermentation of certain vegetables, or of animal matter, an offensive gas is produced before decomposition can be perceived to have begun.

<sup>1</sup> Philadelphia Journal, No. 13, p. 9.      <sup>2</sup> Ibid. p. 13, note.



We know also that the dense gas which produces the evil has no smell (195); and that the strong smelling gases are not dense.

Therefore, the strong smell in those places least affected, is no proof of the degree of decomposition going on there; nor of the presence of the dense gas, the known cause of the disease.

575. From the face of the account it is evident, that in all these places the exemption from sickness rested on the abundance of water preventing the action of the sun on the marshes; and from the extreme unhealthiness of that post, where "the marshes *approached* to the state of terra firma, and little or no *water* was to be seen on the surface," it is evident that as soon as the marshes were brought into a state favourable to putrefaction, and *before* exsiccation had taken place, the pestiferous gas was produced.

576. The same is shown by the effect of an uncommonly dry summer on the health of one of these very places. Dr. Rush says, "Dr. Gordon informed me that five hundred persons died of the yellow fever in Berbice, between July 1804, and May 1805, during which time there fell not quite three inches of rain. The earth in this case was every where dry and parched"<sup>1</sup> (430). It is to be remembered that the rains are very abundant in that country (420. 426). It is very evident that this extreme drought, in so hot a country, was precisely the weather most favourable to the production of miasmata in "a most offensive swamp" (573). It is the very weather which always produces severe epidemics near marshy places (436

<sup>1</sup> Rush's Works, Vol. 4, p. 111.

to 438); and it is to be observed, that the severest cases, in these dry seasons, occur near streams and marshy places.

577. It may also be observed, that as the account of Dr. Gordon and Dr. Frost (430. 431) enables us to explain the difficulty Dr. Ferguson found in reconciling this case to the doctrine of the production of endemic fever, by a gas arising from putrefying vegetable matter; so Dr. Ferguson's account enables us to explain the difficulty Dr. Rush found on the other extreme, of the occurrence of endemic disease in (as he supposed,) the absence of moisture and putrefaction.

578. The same is manifest from the case of Trinidad (560). In that island, "almost all swampy, and the centre of which may be called a sea of swamp, where it always rains at least nine months in the year, if it only rained eight, or if at any time there was a cessation of the preserving rains, the worst kind of remitting fevers were sure to make their appearance."<sup>1</sup> Is it not manifest that exsiccation never occurred in such "a sea of swamp?"

579. If we suppose such a marsh to be exsiccated, it is evident that it will, in becoming so, *pass through* the state best calculated for putrefaction, and that this will precede exsiccation. In countries far enough north, as Spain, or sufficiently *elevated*, as Abyssinia, to be rendered cool by the rains in the forepart of the summer, the absence of heat delays the appearance of sickness, sometimes even until the general aspect of the country be dry. On the contrary, in countries like

<sup>1</sup> Philadelphia Journal, &c. No. 13, p. 8.

Senegal, hot in the extreme, very soon after the rains begin, sickness appears. The appearance of disease, therefore, though sometimes delayed till exsiccation takes place, often occurs *without* it; but *never* without the circumstances favouring decomposition of vegetable matter, even when it begins immediately after the fall of the rains. Lind says, "the first rains which fall in Guinea are commonly supposed to be the most unhealthy; they have been known in forty-eight hours to render the leather of the *shoes* quite mouldy and rotten,"<sup>1</sup> &c.

580. A very strong argument against the doctrine of Dr. Ferguson is, that the autumnal fever often appears on board of vessels at sea. Of this, instances have already been given (168 to 175). On board of the *Busbridge*, Indiaman, on a voyage from England to the East Indies, when the ship had arrived near the line, the yellow fever broke out.<sup>2</sup> On board the *General Green* also, which vessel left Newport, in New-England, in June, and sailed to the Havanna, the yellow fever broke out at sea.<sup>3</sup> A remarkable case is stated in one of the late journals, of a violent fever breaking out in a ship; in consequence of which the attention of her officers was turned to having her cleansed, when several boat-loads of very offensive matter were discovered in her hold underneath a platform of boards, very similar to marsh mud.

581. In these cases it is very evident that the condition of Dr. Ferguson does not take place, viz. paucity of water where it has lately abounded (551); and

<sup>1</sup> Lind on Hot Climates, p. 35.

<sup>2</sup> Medical Recorder, No. 4, p. 541.

<sup>3</sup> Ibid. p. 533.

it is as plain that the same mass of corruptible matter was present, as in many others already stated (340).

582. Exsiccation, therefore, is not essential to the production of the endemic diseases of hot weather; and these *never* occur without the decomposition of vegetable matter; and we find it the result of universal experience, in all times and places, that putrefaction of vegetable matter is the *conditio sine qua non* of the presence of these diseases, and that a dense gas thence arising is the cause.

*Note.* The following case should have been mentioned before; but this part of the work was printed in the midst of incessant engagements during a severe epidemic, and the passage was overlooked. It should have been inserted between 545 and 567; it is therefore noticed here.

Dr. Ferguson mentions in a note an instance in England of a spot absolutely destitute of vegetation, which was nevertheless subject to fevers produced by marsh poison. "The point of Dungeness is a tongue of land appended to the great Romney marsh, and consists of an extensive bank of shingle or gravel, so dry, loose, and open, that, even during wet weather, horses sink in it nearly up to their knees. The forts and barracks are at least four miles from what may be called the main land, where the grass begins to grow; yet was there no spot of that unwholesome tract of country more prolific of endemic fever during the hot summer and autumn of 1817, than these barracks."

It is evident, that in so hot a season as that of 1817 is stated to have been, miasmata must have abounded in this extensive tract of marshy and unhealthy country; and the access to the post at Dungeness being through it, every one passing and repassing was exposed to the operation of the unhealthy air. Moreover, the whole distance from the body of the marshy tract to the post being a flat surface, every wind which blew in that direction must have carried the miasmata then abounding to the barracks. It is certain that in this, as in every other case stated by Dr. Ferguson, there was a marsh close at hand, in circumstances to produce the effect observed: and where there was no marsh near, as at Lisbon, in Berinuda, &c. (439), there was no sickness.

## CHAPTER VII.

### OF THE NATURE OF THE GAS, AND ITS IMMEDIATE EFFECTS ON THE HUMAN SYSTEM.

583. The nature of the dense gas, which bears the name of miasmata, is not an uninteresting subject. If we could ascertain it, effectual means might be devised to counteract its influence. The following considerations are offered on the subject.

The elementary parts of vegetable matter are carbon, oxygen, and hydrogen: a few contain azote, but these are not often met with in marshes. The gaseous combinations which may arise from the decomposition of vegetable matter and the re-union of these elementary parts, are carbonic acid gas, carburetted hydrogen gas, and hydrogen gas. Of these, the two latter are light and fly off immediately. The former is the only gaseous product of putrefying vegetable matter, dense enough to remain on the surface of the earth, and to drive with the wind. If azote should arise in any case, it is not dense enough for this. The carbon is capable of combining with hydrogen in a different proportion from that which occurs in the carburetted hydrogen gas, and also with the azotic gas; but these compounds are only observed during certain processes of the laboratory.

584. A dense gas arising from putrefying vegetable matter, being the cause of the diseases observed in



the neighbourhood of marshes ; and the carbonic acid gas being the only dense gas known to arise in such circumstances, we are led to infer that the carbonic acid gas is the cause in question ; and the truth of the inference is strongly supported by a comparison of the properties of the gases, of the circumstances in which their effects appear and disappear, and of the nature of these effects.

585. Both these gases are denser than the atmospheric air, so as to remain at the lower part of it, and to drive with the wind along the surface of the earth.

586. "Dr. Dalzelle says he once checked a bilious fever by spreading twelve barrels of lime over a piece of marshy ground, from whence the exhalations which produced it were derived."<sup>1</sup> The carbonic acid gas has a strong disposition to combine with lime ; it unites with it in preference to the alkalis.

587. The unknown gas does not produce its effects across water, unless it be in great force, and at very short distances. Lind recommends living on the water in very sickly countries to escape it. Some families in Philadelphia, in 1793, escaped the disease entirely by living in vessels in the river.<sup>2</sup> Dr. Ferguson says, "it is certainly lost and absorbed by passing over a small surface of water."<sup>3</sup> The carbonic acid gas readily unites with water.

588. "Mercurialis relates, (says Dr. Mead,) that the plague in Venice was augmented by burning a large quantity of infected goods in the city."<sup>4</sup> He also states, that after making the same experiment in the

<sup>1</sup> Rush's Works, Vol. 4, p. 131.

<sup>2</sup> Ibid. p. 130, Pringle, p. 57.

<sup>3</sup> Philadelphia Journal, &c. No. 13, p. 18.

<sup>4</sup> Mead's Treatise on the Plague, p. 120.

last plague at Marseilles, the disease spread every day more and more through the city.<sup>1</sup>

Large fires, Dr. Hodges states, were made in all the streets of London for three days together, in the time of the great plague; and there died in that week many hundred more people than in the week preceding, although the disease was on the decline.<sup>2</sup> The effect of these fires was the production of an immense quantity of carbonic acid gas; and from the extent, irregularity, and narrowness of the streets of London, at that time, there was little opportunity for its immediate dispersion.

589. A wood, or thick growth of bushes, interposed between a marsh and a dwelling house, saves the inhabitants from the effects that would follow but for the interposition. It is impossible that a gas should be unable to pass through the trees with the wind which brought it thus far. It is manifest that it is *arrested* by the wood; and the fact of the carbonic acid being *consumed* by the wood, completely accounts for the salutary effects of its interposition.

590. It is a matter of common observation, that the blood drawn from persons who have been exposed to the exhalations arising from marshes, is darker than usual. It is often nearly black, even in those persons who are not ill, the darkness being in proportion to the degree of exposure.

In Goodwyn's excellent treatise on "the connexion of life with respiration," he says, "It has been shown already, that when the same air is breathed several times, or when it is retained in the lungs longer than

<sup>1</sup> Mead's Treatise on the Plague, p. 132.

<sup>2</sup> Ibid. p. 131.

usual, there is a gradual diminution of the dephlogisticated air, (oxygen gas,) and an increase of fixed air (carbonic acid gas.") "When the dephlogisticated air is thus diminished, the ordinary change of colour which the blood undergoes in the lungs, will be also diminished, till at length it will pass through the pulmonary veins with the same black colour as when it entered into the arteries."

"I forced a considerable quantity of air into the lungs of a small dog, whose sternum had been removed, and confined it there by a tight ligature round the trachea: the blood continuing to circulate through the lungs in this state, began immediately to put on a shade of brown in the trunks of the pulmonary veins; and in less than two minutes it became very black."<sup>1</sup> The same experiment was tried on toads and lizards with the same result.

The dark colour of the blood, therefore, takes place when an increased quantity of the carbonic acid gas is present, as completely as under the influence of marsh miasmata.

591. The effect of carbonic acid gas directly applied in a confined situation, is to "produce at first a sense of uneasiness, then chilliness, sickishness, and a kind of head-ache, which ushers in loss of sense, a fixedness of the eyes, a rigidity of the whole body, a ghastly countenance, a small, frequent, and irregular pulse, feverishness,"<sup>2</sup> &c.

These are effects very commonly observed in persons exposed to the operation of marsh miasmata.

<sup>1</sup> Goodwyn on the Connexion of Life with respiration, p. 66. 67.

<sup>2</sup> Motherby's Dictionary, Carbo.

592. A very large proportion of carbonic acid gas in a confined place extinguishes a lighted candle and destroys animal life.

So also does the gas which produces endemic fever. See the case of the Childers (170), in the hold of which ship the seamen declared candles would not burn, upon many occasions, when they were sent into it. The same thing occurred in the case of the ship of war General Green, on her voyage to Havanna.

593. To sum up the whole, the unknown gas is dense, and arises from putrefying vegetable matter (178).

The carbonic acid is a dense gas arising from putrefying vegetable matter, and the only one known to exist.

The miasmatic diseases are most prevalent in the afterpart of the summer, showing the abundance of the unknown gas.

At the same time carbonic acid gas abounds, in consequence of the profusion of dead and decaying vegetable matter.

The unknown gas drives with the wind.

Carbonic acid gas does also.

The unknown gas, according to Dr. Dalzelle's account, is absorbed by lime.

Carbonic acid gas has a strong disposition to combine with lime.

The unknown gas is readily absorbed by water.

Carbonic acid is readily absorbed by water.

Large fires in great number in a town, increase the effects arising from the unknown gas.

Carbonic acid gas is produced in immense quantity by them.

The unknown gas is arrested by a wood, and prevented from producing its effects beyond it.

Carbonic acid gas is consumed by a wood, and thus effectually arrested.

The unknown gas changes the blood of those exposed to its influence to a brown, and finally to a black.

Carbonic acid gas does the same.

Carbonic acid gas produces a sense of uneasiness, chilliness, sickishness, head-ache, &c., a small, frequent, and irregular pulse, feverishness, &c. (591).

The unknown gas also produces a sense of uneasiness, &c. &c.

The unknown gas extinguishes lighted candles, and destroys animal life suddenly.

Carbonic acid gas does the same.

594. Admitting then the existence of a dense gas, the product of putrefying vegetable matter, other than the carbonic acid gas; there are two gases thence arising, one known, the other unknown; both denser than the atmospheric air; both producing the same effects; both driven by the wind along the surface of the earth, so as to make their effects visible at a considerable distance; and both arrested by the interposition of a wood between the source whence they proceed and a distant object, whereby the usual effects are prevented. It is moreover impossible that the unknown gas can arise from vegetable matter in a state of decomposition, without the presence of carbonic acid gas; so that the former never exists without having along with it, in the latter, a cause capable of producing every effect attributed to it.

It would therefore be a violation of Newton's first



rule of philosophizing to admit the existence of any other than the carbonic acid gas. This gas is therefore the cause of the autumnal diseases.

595. The effect of this gas we have seen is to render the blood brown, and finally black (590). This black blood does not stimulate the heart as the florid blood does. In his experiments on the respiration of different animals, Goodwyn says, "he attended carefully to the changes in the colour of the blood, and in the corresponding contractions in the left auricle and ventricle of the heart; and in all the examples observed, that when the blood which passed into the left auricle was florid, the auricle and ventricle contracted strongly, and the circulation went on as in health; but when the blood began to put on a shade of brown the contractions were diminished, and when it was black the contractions ceased, although the auricle was distended with blood,"<sup>1</sup> &c.

Thus, weakened action of the heart is the consequence of respiring the dense gas arising during the putrefaction of vegetable matter.

596. The general doctrine is not implicated in the discussion respecting the *nature* of the dense gas, known by the name of marsh miasmata (583, &c.). Whatever be the nature of this gas, it renders the blood brown, and finally black, which thereby becomes less stimulant to the heart (595). Nor is this effect confined to this dense gas; any gas arising from putrefying vegetable matter, has the same effect of weakening the action of the heart, if prevented from flying off, or if retained so as to be respired. Dr. Beddoes

<sup>1</sup> Goodwyn on the Connexion of Life with respiration, p. 72 to 81.

says, "he never saw an instance in which a lowered atmosphere did not at the moment quicken the pulse, while it weakened the action of the heart and arteries."<sup>1</sup> But this gas, being the only one dense enough to rest on the surface of the earth, is the only one actually present when the effect is produced.

<sup>1</sup> Darwin's *Zoonomia*, Vol. 2, p. 479.

## CHAPTER VIII.

### ORIGIN OF WINTER EPIDEMICS.

597. Although autumnal epidemics cease, for the most part, with hot weather, it is not unusual for the first cold weather to produce an increase of the number of cases; and they continue to occur throughout the winter, sometimes in considerable numbers. Thus, in the epidemic in the neighbourhood of Portland, Maine (213), Dr. Barker attended "in July six cases, in August sixteen, in September twenty-five, in October twenty-four, in November nine, in December eight, in January fifteen, in February six."<sup>1</sup>

598. It is evident from the increase of cases on the access of cold weather, or on sudden changes to colder weather; and from some of the symptoms being such as are commonly produced by cold; that this remote cause has considerable influence in producing these fevers. But that cold alone is not the cause is obvious, when we reflect that they are sometimes mild and not very prevalent in the coldest winters; and that the reverse sometimes happens in comparatively mild winters. Some other remote cause is therefore in operation; and it will appear from a consideration of the state of the persons attacked on the access of cold weather, from the symptoms, and from the

<sup>1</sup> Medical Repository, Vol. 3, p. 365.

topography of the places in which these cases occur, that they are produced by the joint operation of miasmata and cold.

599. The effects of the remote cause miasmata are paleness or sallowness, black blood, black and green discharges from the stomach and bowels, &c. The whole of these effects do not appear in all exposed. Some are ill; others complain only of chilliness, pains in different parts, &c.; others feel pretty well, but have little or no appetite; others, in addition to want of appetite, feel a loathing; or, if there be no loathing, the stomach is so irritable that on eating a meal it is soon after rejected; all are more or less sallow; some who are apparently well have black tongues; blood drawn from persons not indisposed is nearly black; the serum is yellow; the discharges from their stomachs and bowels are frequently green or black, particularly if a mercurial cathartic be taken.

600. It is certain, therefore, that the whole population of a neighbourhood exposed to miasmata, is under the influence of this remote cause of disease and affected in various degrees. Numbers are on the verge of an attack at every period of the autumnal season, and are still so at the moment of the access of cold weather. The process of putrefaction, and the production of miasmata, thereupon ceasing, the cause ceases to operate, and the effects gradually disappear. This, however, takes time; and although most of those thus influenced escape, particularly those lightly affected, all do not, and we meet with cases in every period of cold weather, in which the effects, black blood, green or black discharges from the stomach and bowels, are observed.

601. In seasons in which miasmata abound, greater numbers are on the verge of an attack throughout the fall, and also at the time of the access of cold weather, and for some time after.

In the course of the autumnal season, fever is often induced in persons under the influence of miasmata, by exposure to cold, sometimes during sleep in cool nights, or by neglecting to change wet clothes. If, while the population are still under the influence of miasmata, the access of cold weather be sudden, or the weather be severe, the operation of cold being general, greater numbers must necessarily suffer an attack; and this is particularly the case in winters following seasons in which miasmata abound.

602. According, therefore, to the degree of exposure to cold, some have simple bilious remittent or intermittent fever, with the precise symptoms which occurred in the autumn; while in others catarrhal or pneumonic symptoms also appear. Even in those cases in which the disease is considered as pneumonia, the lungs are often not affected. Cleghorn dissected several bodies dead of pleurisy, as he thought, and found the pleura sound.<sup>1</sup> In some cases, however, pneumonia is unquestionably present, together with the clearly marked symptoms of the autumnal disease preceding.

603. It is manifest from this statement that these winter diseases occur in persons exposed, while under the influence of miasmata (600), to the action of cold; and that the symptoms observed are those produced by miasmata, in connexion with more or less of those produced by cold. Wherefore they are the effects of the joint operation of miasmata and cold.

<sup>1</sup> Cleghorn's *Diseases of Minorca*, p. 247.



604. It is manifest that the symptoms produced by the one or the other cause, must predominate in proportion to the power of the predominant cause.

Thus, of persons influenced equally by miasmata, those most exposed to the action of cold will experience most of its peculiar effects, catarrh or pneumonia. The same holds good, as well when applied to different years, as to individual cases. In those winters following autumnal epidemics in which we are most exposed to cold, that is, in which the weather is most severe, catarrhal and pneumonic affections predominate; while in the mild winters, the cases are almost free from them, the symptoms being almost entirely those of the preceding autumnal epidemic. Thus in the winter of 1814, which was very severe, the snow being two feet deep in this country, the pneumonic symptoms predominated, and the disease was very mortal. All the symptoms of autumnal fever were, however, also present, viz. besides the ordinary symptoms common to fever in every form, green and black discharges from the stomach and bowels. In the remarkably mild winter of 1823, the catarrhal symptoms were common, but pneumonia did not occur in more than a single instance in my practice. The cases were almost uniformly bilious remittent, with all the symptoms as strongly marked as in the autumnal season.

The winter of 1824 was the mildest ever known in this country in the memory of the living; the ground was not frozen except during one week in February, perhaps the whole winter. In consequence of this the streets were very muddy, and the feet of those whose

business called them out, were frequently wet the whole day. Bilious cases of high grade were common. In the beginning of February the weather was very cold for one week. This caused a great increase of the number of sick, and almost universally a cough and oppression of the breast were added to those symptoms which appeared previously; but no case of pneumonia occurred in my practice.

605. These cases sometimes continue to occur through the winter. As some persons continue under the influence of miasmata through the autumn, and fall into fever on the accession of the action of another remote cause, cold; so others, better protected, or more careful against cold, continue in the same state through the winter, until, on some sudden exposure, fever is produced.

606. In confirmation of this explanation (603), we find such winter epidemics occur frequently in the north, after summers particularly calculated to produce miasmata; as in the case of Portland (213); or in southern countries where disease from miasmata is common every year, on the occurrence of unusually cold weather; or, as in the north, even in winters of ordinary severity, after autumns in which an uncommon quantity of miasmata is produced. It is further confirmation of its correctness that these winter epidemics, both in the north and in the south, occur in situations in which miasmata are known to abound.

607. The following cases illustrate all these particulars (597 to 606), as well as the general doctrine of the dependance of these winter epidemics, as well as those of the summer, on miasmata.

608. In the autumn of 1798 a severe epidemic prevailed in Portland, Maine, and continued throughout the winter; the particulars of which have been already stated (213. 597).

609. "Bilious intermitting fevers are very prevalent during the autumn in the level countries near the sea-coast of North Carolina. They also prevail near the rivers for some distance above the low lands." "Those intermitting fevers disappear as the cold weather sets in, but they are frequently succeeded by fevers of a different type, that are more fatal. Those fevers of the colder season are commonly attended by symptoms of partial inflammation, whence they are denominated pleurisies of the *eye* or of the *head*; at other times they affect the *side*. In those several forms they are *equally* dangerous." "It commonly attacks people who have been afflicted by intermitting fevers during the summer and autumn. It appears *chiefly*, perhaps *only*, in *those places* where people are subject to *intermitting fevers*, in low sunken grounds, and along the banks of rivers. In the beginning of winter, in the year 1792, that fever was very fatal in Martin county, near the river Roanoke; the river had lately been very low, and much of the muddy bottom and other grounds usually covered by water, had been exposed to the sun. The pain was then in the head. In the year 1794, ten or twelve men, the heads of families, adjoining one another, died of that complaint in December, on the river Neus. They had lived near the beginning of the high grounds on the north-east side of the river. There had been a dry season, and the winds were generally from the south-west. The

other inhabitants of the adjacent country, except on that narrow strip by the river, enjoyed good health. In the year 1792, to the best of my recollection, in the beginning of winter, this pleurisy in the head, as it was called, was endemic near Matamusket, in a settlement where the land is rich but very low, and much of it covered with water.”<sup>1</sup>

610. Greenville is a small town on the south side of Tar river, built on a pleasant spot of considerable elevation, and nearly insulated by the river and two branches on the east and west sides of the town. The land on the north side of the river is low, broken by ponds, and subject to be overflowed during a fresh, which occurs five or six times a year, to such extent as to cover the low land half a mile from the banks. The miry state of the branches, in many places, renders them dangerous to cattle. South of the town, and nearly a mile distant, is a mill-pond, the dam of which was broken during the summer, by which a considerable extent of its muddy bottom, &c. was exposed to a hot sun for nearly two months. The land between the town and this pond, is mostly under cultivation. July, August, September, and October, were distinguished, as usual, by the prevalence of bilious fevers: however, the fevers of this year were more particularly marked.

In February, March, and April, a fever proved very mortal in town and country. Some physicians called it bilious peripneumony. The attack was made by chill or ague: before this was entirely worn off, a pain of the head, breast, side, or back, seized the patient,

<sup>1</sup> Medical Repository, Vol. 2, p. 156, by H. Williamson, M. D.

and frequently several of these symptoms at once, increasing in violence as the fever came on, and during its progress. The pain in the side was accompanied by a cough and expectoration of bloody matter.<sup>1</sup>

611. In the 7th volume of the Eclectic Repertory, we have an account by Dr. Davis, of Columbia, in South Carolina, of a winter epidemic which commenced in that town in November, 1815, immediately after the common bilious fever. It prevailed in other parts of the state also, and "the most swampy situations, margins of rivers, and places most subject to the endemial autumnal bilious fevers, suffered most severely from the epidemic."

612. In the same paper, Dr. Trent, of Richmond, in Virginia, in a letter to Dr. Davis, gives an account of an epidemic in the winter of 1815 in that city. "A highly bilious character sometimes attended it. The patient not only throwing off a great deal of vitiated bile, but becoming very yellow. The liver was sometimes the part on which the disease spent its force. A very frequent form of the disease was that of bilious pleurisy."

613. The winter of 1814 was very severe in Fauquier and the neighbouring counties. The snow was unusually deep. An epidemic prevailed in the winter. In reply to a request made to a friend, Dr. Withers of Warrenton, for information on the subject, he wrote, "In Fauquier the epidemic was most prevalent and fatal in *the marsh*, about Woodside's; the face of the country is low and very wet. There were some cases on Tinpot (run). They generally complained of pain

<sup>1</sup> Medical Repository, Vol. 5, p. 137, by Dr. G. Pillson.



about the thorax ; the blood when drawn was sily ; stools dark green, expectoration saffron coloured. There were cases without pain in the thorax ; there was pain occasionally in the head and limbs ; some complained of the toes only. There were not more than two or three cases in my practice, above the road leading to Fayetteville." The country above that road is high and hilly. The very same parts of the country were most affected in the autumnal epidemic of 1821. The same disease was excessively severe along the Potomac and Rappahannock rivers, a country peculiarly liable to autumnal diseases.

614. In Winchester the autumnal epidemic of 1822 was followed by a winter epidemic. A snow storm in February covered the earth a foot deep. This, with cold north-east winds and rain in the last of that month and first of March, produced considerable sickness. The symptoms were such as are common in the autumnal season, bilious passages, &c. together with catarrhal symptoms. I met with one case in which these symptoms rose by degrees to that grade of the disease which has been called peripneumonia notha.

615. In the fall of 1823 the town was healthy ; and the whole winter remarkably so. I met with but one case of bilious pleurisy ; in which there was a violent cough, pain in the side, with remarkably dark bilious countenance, and black passages for a fortnight. This case occurred in February, very near to a mill-pond, in a house noted for the number of sick persons in it in every autumnal epidemic.

616. In the fall of 1824 the town was sickly ; and the beginning and end of the winter, particularly Fe-

bruary, March, and April, were very sickly. Catarrhal affections were common; but in most cases the disease was a bilious remittent of high grade. The discharges were generally black, and nausea common. In one instance the stomach was excessively irritable, and the discharges by vomiting, as well as those from the bowels, were perfectly black. After some days of evacuation by mercurial cathartic pills, finding the stomach still discharging black matter, though aware of the effects of emetics in autumnal diseases of high grade, I ventured to give fifteen grains of ipecacuana. The patient vomited about thirty times, and it required considerable efforts to stop the operation.

617. In the fall of 1825 the town was also very sickly; and the forepart of December, and after the middle of January, the winter was sickly. The weather, particularly in the latter part of the winter, was very severe. There was a number of cases of pneumonic inflammation, with bilious symptoms, and dark green discharges.

618. In 1826 the weather in the latter part of the summer was cool and pleasant (379), and an epidemic appeared late in the season. It was, however, very severe. In addition to the regulations of the streets by public authority, above alluded to (375), there were some pathways raised a foot or two above the level of the street, for the convenience of passing across the flat wet ground between the main street and the next street west of it. This was done in the spring of this year. The south-west quarter of the town, in consequence of these things, had several ponds in it from one to six inches deep. The houses mentioned

before as having suffered from such wet spots, are in that quarter. The disease prevailed very generally along this flat ground on both streets. Of the whole number of cases, nine-tenths occurred in this south-west quarter, and along the stream that passes through the town.

The disease has much abated for some time; but already (middle of November,) have bilious pleurisies made their appearance, after a very cold rain and wind. The discharges are of a black, or bottle green colour. In one case now under my care, the patient was bled freely, and completely relieved from the pain in the thorax and the difficulty of breathing, and has been some days passing black bile. It would be impossible for any one to discover in her at this time, any other symptoms than those of autumnal fever. In another case, after the pain in the side and the cough were removed, the dark passages, and other symptoms of the autumnal epidemic, continued; and among others, a remarkable difficulty of operating on the bowels.

I have observed precisely the same in former winter epidemics.

619. In Philadelphia, in the winter following the great epidemic of 1793, it was observed that the symptoms of yellow fever appeared in combination with those of pneumonia.

Dr. Rush, speaking of the diseases of that winter, says, "But the diseases of the winter had a peculiarity still more extraordinary; and that was, many of them had several of the symptoms of the yellow fever, particularly a puking of bile, dark coloured stools, and a

yellow eye." He further mentions several cases of pneumonia, in which appeared symptoms of yellow fever; as yellow eyes, dilated pupil, and redness of the eyes in the degree common in yellow fever.

Dr. Griffitts attended a patient in pneumonia who had universal yellowness of the skin.<sup>1</sup>

620. In the year 1794 there were many cases of yellow fever.<sup>2</sup> "The cold weather in October checked the fever, but did not banish it from the city. It appeared in November, and in all the succeeding winter and spring months." The winter was moderate.<sup>3</sup> There was an uncommon mortality in the months of January, February, and March, 1795<sup>4</sup> (608 to 614).

In 1795 there were some cases of yellow fever, and the different forms of autumnal fever were of a pretty high grade.<sup>5</sup> "The winter was uncommonly moderate. There fell a good deal of rain, but little snow." "Catarrhs were frequent." Several cases of bilious malignant fever appeared in March and April.<sup>6</sup>

In 1796, August, September, and October were uncommonly healthy. The winter was in general healthy. During the spring, though cold and wet, no diseases of any consequence occurred.<sup>7</sup>

In the autumn of 1797 the yellow fever prevailed in

<sup>1</sup> Rush's Works, Vol. 3, p. 102.      <sup>2</sup> Ibid. p. 199, &c.

<sup>3</sup> Ibid. p. 201.

<sup>4</sup> Ibid. p. 232.

<sup>5</sup> Ibid. p. 242.

<sup>6</sup> Ibid. p. 243.

<sup>7</sup> Vol. 3, p. 244. Vol. 4, p. 3. It is proper to observe, that in the edition of 1818 of Rush's Works, there is an error in inserting 1796 for 1795, in the passage, "The winter of 1796 was uncommonly moderate," Vol. 3, p. 243, as will appear on comparing this passage with one in the next page, viz. "The weather in December was extremely cold," &c. There is another in inserting 1797 for 1796, at the commencement of the account of the fever of 1797, Vol. 4, p. 3, as will appear on comparing that passage with the commencement of the account of the fever of 1798.

Philadelphia, and “was succeeded by scarlatina, catarrhs, and bilious pleurisies in the months of November and December of the same year.” The diseases of February and March were catarrhs and bilious pleurisies.<sup>1</sup>

In 1798 a most violent yellow fever raged in Philadelphia. The diseases in November and December were highly inflammatory. A catarrh was nearly universal. The weather in December was extremely cold. About the middle of January the weather moderated, but “the weather was very cold, and bilious pleurisies were common during the latter part of February.” It was still cold in the first half of April, and diseases, though fewer than in winter, were still bilious and inflammatory.<sup>2</sup>

The yellow fever again prevailed in 1799. There is no mention of the health of the city in November and December; but in January the cold was not so great as common. Catarrhs, cynanche trachealis, and bilious pleurisies were prevalent in every part of the city. A few cases of yellow fever occurred likewise during this month. March was unusually healthy, and the weather warm in April, and the city as healthy as in March.<sup>3</sup>

In the autumn of 1800 in Philadelphia there were in September twenty-one cases of yellow fever in Spruce-street, between Front and Second streets, all in the neighbourhood of putrid exhalations; but the city in general was so healthy, while other cities suffered, that Rush endeavours to account for it.<sup>4</sup>

<sup>1</sup> Rush's Works, Vol. 4. p. 39.      <sup>2</sup> Ibid. p. 55.

<sup>3</sup> Ibid. p. 63.

<sup>4</sup> Ibid. p. 64.



The months of November and December were uncommonly healthy.<sup>1</sup> "The month of January was intensely cold. In February it became more moderate. The diseases, during these two months, were catarrhs and a few pleurisies. In March and April there fell an unusual quantity of rain." A few mild cases of *scarlatina anginosa* appeared in these months.<sup>2</sup>

In autumn 1801 the city was healthy. No winter epidemic but the measles.

In 1802 there was a considerable number of cases of yellow fever. No mention of the diseases of November and December, but the weather in January was uniformly cold, and in February there was a thaw; and the diseases of both these months were catarrhs and bilious pleurisies. The latter appeared in a tertian type.<sup>3</sup>

In the autumn of 1803 the city was sickly. In January following the weather was clear and cold, with deep snows and rain, and was healthy. In February there was a deep snow, followed by several very cold days; there was also a fall of snow in March, followed by an uncommon degree of cold. Catarrhs and bilious pleurisies were very common during both these months. In the beginning of April the weather was cold and rainy. Bilious pleurisies were still the principal diseases which prevailed in the city.<sup>4</sup>

In 1804 there was less sickness than usual in the forepart of the autumn, but in October intermittents were very common between Eighth-street and the Schuylkill. The winter was uncommonly cold and

<sup>1</sup> Rash's Works, Vol. 4, p. 65.

<sup>3</sup> Ibid. p. 83.

<sup>2</sup> Ibid. p. 69.

<sup>4</sup> Ibid. p. 91.

tempestuous; and during January, February, and March, there was a number of bilious catarrhs and pleurisies.<sup>1</sup>

621. Dr. Rush has given no account of the winter diseases after this year, and very few notices of the autumnal. He says, however, that "Dr. Huxham and several other physicians describe bilious fevers in open winters, and particularly after a sudden thaw has succeeded a great frost."<sup>2</sup> This is precisely what I have observed uniformly. Bilious pleurisies are most frequent in the beginning of winter, when there are cold rains and the ground is wet and cold; and towards the end of winter, when there is a general thaw, very often brought on by rains; while during the uniform cold weather of mid-winter, when the earth is dry, and it snows instead of raining, it is much more healthy. They occur also in very cold weather.

622. The fever which prevailed in Portland, Maine, in the autumn of 1797 (213), continued through the winter until March.<sup>3</sup> The fever of the autumn of 1798, in the same place, continued till February (597).

623. Bethlehem township, Connecticut, four or five miles square, is ridged into hills running due north and south. There are six of these ridges, and in each valley there is a stream of water. The soil is very fertile. It was settled in 1730, and continued healthy until 1750. In 1748 a man built a dam across the central valley, in order to kill the timber on a piece of flat ground containing about fifty acres. The ground

<sup>1</sup> Rush's Works, Vol. 4, p. 95.

<sup>2</sup> Ibid. p. 103, from Huxham on air and epidemic dis. Vol. 1, p. 19.

<sup>3</sup> Medical Repository, Vol. 2, p. 150.

continued covered until the spring of 1750. The water was then let off, and was followed by a pestilence, which carried off a number of the most robust inhabitants. The summer was a very hot one.

624. As few of the physicians, and still fewer of the people, thought the ponded swamp the cause of the disease, ten years after what the old people called the first great sickness, the same low ground was again overflowed. After the letting out of the water in 1760, another wasting sickness began in the month of November, and carried off about forty inhabitants; this was called a malignant pleurisy.<sup>1</sup>

625. From this it appears, that, as the cause in every autumnal epidemic falls short of producing the disease in numbers, though it produces in every one a greater or less approach to it; it may fail of producing evident disease in any, but may leave the whole population on the verge of it, and produce, by the co-operation of cold, an epidemic in the winter and spring.

626. It is not a valid objection to this doctrine, (that the winter is but the *continuance* of the summer epidemic, derived from miasmata, and continued by the *co-operation* of cold;) that many are taken sick in high places where miasmata do not abound. It is certain that miasmata are so far diffused as to produce some effect even in those who live at some distance from marshes. During the epidemic of 1823, I did not bleed a single person for indisposition of any kind, or however slight, in the town of Winchester, which was then very healthy in comparison with the neighbourhood, whose blood did not resemble in blackness and con-

<sup>1</sup> Medical Repository, Vol. 1, p. 523, Rev. A. Backus.

sistence the blood of those who suffered attacks of fever in the country.

The winter epidemic then, although like the summer, it is most prevalent in low places ; because there the two remote causes, cold and miasmata, co-operate in full force ; is found in high situations in greater proportion than the summer diseases, because, although one remote cause, miasmata, is there weak, the other one, cold, is as strong as in the low places.

627. There are two causes operating ; the one confined for the most part to low places, the other general. While the former operates alone, the sick are chiefly found in low places. When the latter begins to operate, its action not being confined to low places, but extending with equal power to high situations, the proportion of the sick must be increased in them. If the power of miasmata in low places be to the same in high situations as four to one, the number of the sick in the former will be, to those in the latter, as four to one. If the power of the other cause, cold, be represented by the number two ; as it acts on all alike, the joint effect on the low places will be as six, and on the high as three. Thus, although a greater number are still sick in the low places, there is a greater proportion in the high.

628. It is evident from the preceding statements, that winter epidemics prevail in situations in which miasmata abound in the autumnal season (608 to 611. 613. 614. 616 to 620. 623. 624) ; that they occur in winters following those seasons particularly favourable to the production of miasmata (608 to 611. 614. 616 to 620. 624) ; and that they do not occur in win-

ters following healthy autumns (615. 620, in 1796, 1800, 1801); that the symptoms manifestly indicate that they are the joint effect of miasmata and of cold (612 to 619. 620, in 1794, 1795, 1797, 1798, 1799, 1802, 1803, 1804); and that those symptoms of the winter epidemics which originate in miasmata (599), correspond in grade with those of the previous autumnal epidemic (614 to 620). It appears also that many of the cases have no other symptoms than those common in autumnal epidemics (612 to 619. 620, in 1794, 1795, 1799), the operation of the cold being sufficient to produce a fever, as frequently happens in the autumnal season (601), but not to produce its peculiar local effects on the lungs. There are, therefore, in winter epidemics some cases in which the symptoms of catarrh or pneumonia are the most prominent; and some in which they are not to be seen, and the case is without hesitation called a bilious fever, or yellow fever (620, in 1794, 1795, 1799); and even in those cases in which, at first, the symptoms of pneumonia are most prominent, if these be removed by prompt measures, the symptoms originating in miasmata (599) remain, and the disease is not to be distinguished from an autumnal or bilious fever (618). Wherefore it is evident that winter epidemics are the effect of the joint operation of miasmata and cold.

629. It is evident from the whole preceding account, that catarrhs and pleurisies are found prevailing together as the result of the same cause (614 to 620), the latter being the effect of a higher degree of power in the cause. Catarrhs are frequently epidemic, when there are few pleurisies (604. 620, in 1800).



630. As, in some cases which were deemed to be pleurisies, it has been found, on dissection, that the pleura was sound; so in many cases called catarrhs, or colds, from the cough and other symptoms, the lungs are not affected, and there is no expectoration. The cough is violent, but entirely dry; and all the other symptoms show that the disease is the effect principally of miasmata; as in the following case of a child of seven years of age. The sole symptoms were pain in the stomach, diarrhœa, rapid decline in colour and flesh, violent cough without the slightest expectoration. Ten grains of calomel produced black passages, and relieved all the symptoms surprisingly. The cough ceased. The relief was so great, that nothing more was done for a day or two, and the symptoms returned. The same remedy again produced the same discharges, afforded the same marked relief, and soon carried off the disease. This was one of a great number of cases in the winter of 1824 (604).

631. These epidemics, with catarrhal or pneumonic symptoms, have been sometimes called influenza. Dr. Pillson, speaking of the winter epidemic mentioned above (610), says, "From information I am led to think that the same combination of symptoms appeared on this river in the year 1789 or 1790, and was then known by the indeterminate name of influenza."<sup>1</sup>

632. These winter epidemics have been mentioned by several authors, and yet have been very little adverted to by physicians. They are nevertheless regular in their appearance, insomuch that it is not difficult to predict with as much certainty a winter as

<sup>1</sup> Medical Repository, Vol. 5, p. 140, note.

a summer epidemic. If, for instance, we have much rain in summer, and the weather be warm, autumnal fevers are sure to appear in considerable number. So, if after an autumn abounding in miasmata the winter be very cold, as in 1814 (604), or wet, a winter epidemic may confidently be expected.

633. Sydenham gives an account of one of these in the winter of 1675. In the summer and fall of that year, numbers were destroyed by an epidemic fever and dysentery;<sup>1</sup> and the winter epidemic commenced with the first cold moist weather. “In 1675 the season having continued unusually warm, like summer, till towards the end of *October*, and being suddenly succeeded by cold and moist weather, a cough became more frequent than I remember to have known it at any other time; for it scarce suffered any one to escape, of whatever age or constitution he were, and seized whole families at once. Nor was it remarkable only for the numbers it attacked, (for every winter abundance of persons are afflicted with a cough,) but also on account of the danger that attended it. For as the constitution, both now and during the preceding autumn, eminently tended to produce the epidemic fever above described, and as there was now no other epidemic existing, which by its opposition might, in some measure, lessen its violence, the cough made way for, and readily changed into the fever. In the mean while, as the cough assisted the constitution in producing the fever, so the fever on this account attacked the lungs and pleura, just as it had affected the head, even the week preceding this cough; which sudden alteration

<sup>1</sup> Sydenham's Works, Sec. 5, ch. 1.

of the symptoms occasioned some, for want of sufficient attention, to esteem this fever an essential pleurisy or peripneumony, though it remained the same as it had been during this constitution.

For it began now, as it always did, with a pain in the head, back, and some of the limbs; which were the symptoms of every fever of this constitution, except only that the febrile matter, when it was copiously deposited in the lungs and pleura, through the violence of the cough, occasioned such symptoms as belong to those parts. But nevertheless, as far as I could observe, the fever was the very same with that which prevailed to the day when this cough first appeared; and this likewise the remedies to which it readily yielded plainly showed.”<sup>1</sup>

634. Sydenham also mentions a fever, which he had found to prevail from the beginning of winter to the beginning of spring, and calls it the winter fever.<sup>2</sup> He likewise mentions “a fever, attended with several peripneumonic symptoms, which arises every year towards the beginning, but more frequently at the close of winter.” This he calls bastard peripneumony.<sup>3</sup> Though he describes these as different fevers, it is evident from his language, as well as from the symptoms, that they are one. He says, speaking of the winter fever, “if there be much morbid matter, it occasions such a fever as we have described under the head of the bastard peripneumony. But if there is only a small quantity of morbid matter, it only produces the symptoms I proceed to enumerate.”<sup>2</sup>

635. He mentions also another fever, which he calls

<sup>1</sup> Sydenham's Works, Sec. 5, ch. 5.    <sup>2</sup> Ibid. p. 538.    <sup>3</sup> Ibid. p. 267.

a new fever. When he was first called upon in this fever, he “esteemed it the same kind of distemper as the bastard peripneumony,” “with this difference only, that this fever was *sometimes* not attended with those symptoms which characterized and distinguished that disease,” viz. peripneumonic symptoms.<sup>1</sup> His reason for believing it to be a new fever, is given in these words; “but in the beginning of summer, which season commonly terminated those peripneumonic fevers, this fever still continued; *whence*, soon perceiving my error, I was fully persuaded that this fever was to be referred to a new constitution.”<sup>1</sup>

636. It is evident that this is no sufficient reason for reversing a judgment founded on the identity of the symptoms; and that the first opinion was correct. It is also evident from the quotation above (634), that the common winter fever, and the bastard peripneumony, differ only in degree. The identity of all three will appear at once from the following statement of the symptoms of each.

<i>Bastard Peripneumony.</i>	<i>Winter Fever.</i>	<i>The new fever of 1685.</i>
Alternate paroxysms of heat and cold.	The same.	The same.
Giddiness and acute pain in the head, when the cough is most troublesome.	Pain in the head and limbs, and universal restlessness.	Frequently pain in the head and limbs.
Cough, pain in the thorax, difficult respiration.	Generally a cough, but respiration not so difficult.	Generally a cough, with other symptoms of mild peripneumony.
Blood resembling pleuritic blood.	The same.	The same.
Urine turbid and very red.	The same.	Not mentioned.
Not mentioned.	Pulse much the same as in health.	The same.

<sup>1</sup> Sydenham's Works, p. 544.

637. The identity of the whole is here apparent. It is further shown by the direction given by Sydenham, in his treatment of both the winter fever<sup>1</sup> and the new fever,<sup>2</sup> that if difficulty of respiration, or violent pain in the head on coughing, show a tendency to bastard peripneumony, "the patient is to be carefully treated according to the method laid down in our discourse on that disease."<sup>3</sup>

638. Sydenham says little of the weather, but states that the new fever commenced "as soon as it began to thaw in February, 1685." Webster states that the preceding summer was hot and dry.<sup>4</sup> Such a summer, in so flat and wet a country as England, must have produced abundance of miasmata; and the weather in the following February was, in these circumstances, precisely such as we have seen is calculated to produce a winter epidemic (604. 620, in 1802. 621).

639. It is evident, therefore, that these fevers, prevailing at the same time, differed only as the different cases of our winter epidemics differ, viz. some have more and some less of the peripneumonic symptoms. The former are well described in his account of the bastard peripneumony; the latter in the account of the winter fever. But, differing only in the degree of the affection of the thorax, there is no propriety in considering them as different diseases.

640. The summer of 1685 also was hot and dry, and an epidemic prevailed in England. Sydenham says that the fever which commenced in February continued to prevail in summer, the peripneumonic symptoms being slighter as the weather became warmer.

<sup>1</sup> Sydenham's Works, p. 540. <sup>2</sup> Ibid. p. 546. <sup>3</sup> Ibid. p. 540. 546.

<sup>4</sup> Webster's History of Pestilences, Vol. 1, p. 205.



When the fever began in February, he considered it "the same kind of distemper as the bastard peripneumony," and the correctness of the opinion is evident from what is stated above (636). When the summer came on, the peripneumonic symptoms having disappeared, he found that the remaining symptoms identified the disease with the summer fever. Hence, also, it is obvious that the only difference between the summer and winter epidemics, is the addition of the peripneumonic symptoms to the latter.

641. Cleghorn, in his valuable work on the diseases of Minorca, which island we have seen is the seat of violent autumnal epidemics, gives a particular account of very fatal winter fevers appearing about November, and almost depopulating some corners of the island.

They begin "commonly like an ague fit, with shivering and shaking, flying pains all over the body, bilious vomitings and purgings," &c. "the most part of the sick being seized with stitches in their sides, striking upwards to the clavicle, and shoulder blade,"<sup>1</sup> &c. Beside some abatement of the fever common every morning, on the third day, or beginning of the fourth, there was frequently a great remission, sometimes a total cessation of every violent symptom, so that the sick were thought to be out of danger; but on the fourth or fifth, a delirium, &c. carried off the patient in a day or two.<sup>2</sup> In one person, whom he believed to have died of a pleurisy, the lungs and pleura were found on dissection to be sound. He expectorated freely from the sixth to the twelfth day of his illness.<sup>3</sup>

<sup>1</sup> Cleghorn's Diseases of Minorca, p. 242.

<sup>2</sup> Ibid. p. 246.      <sup>3</sup> Ibid. p. 250.

642. Though Cleghorn states that the most part of the sick had stitches in the sides, &c. it is plain from what he says in the beginning of the chapter, that many of the sick had no symptoms of the kind. He says, "The anniversary epidemical fevers of Minorca may be divided into two classes, which at present, for distinction sake, we shall call the summer and winter fevers. The former break out in June or July, and cease about *January*, or somewhat sooner. The latter seldom appear before November,"<sup>1</sup> &c. It is plain from this statement, that of the cases actually occurring in the winter, some resemble so nearly the summer fevers as not to be distinguished from them, and he calls them summer fevers; while others have the additional symptoms of pain about the chest, &c. with expectoration, and that even of these, some, on dissection, are found without any affection of the lungs or pleura. It is this latter class that he describes as the winter fever.

643. These extracts show that in Europe, as well as in America, winter epidemics occur in such situations, and at such seasons, as to make it evident that they are the joint effect of miasmata and cold, and the continuance of the autumnal epidemics; or, as Sydenham says, *the very same fever which prevailed to the day when the cough first appeared.*

<sup>1</sup> Cleghorn's Diseases of Minorca, p. 238.

## CHAPTER IX.

### IDENTITY OF THE AUTUMNAL EPIDEMIC DISEASES.

644. From the identity of the cause of autumnal epidemics, we infer the identity of these diseases. We shall not, however, rest the doctrine on this inference alone, but consider the question at large.

645. In the first stage of every fever the action of the heart is diminished. This is sooner or later followed by increased action, which after some hours more or less moderates or subsides. These two states of the system, the cold and the hot stage, constitute a paroxysm of fever.

646. On the degree of the cold stage is founded the division of autumnal fevers into intermittents and remittents. Both these arise in the same circumstances of heat, moisture, &c. Few epidemics occur in which either is exclusively observed; one predominates, but some of the other almost universally appear also. In many cases it is difficult to say whether the fever is strictly remittent or intermittent. Remittents often become intermittents; and intermittents remittents. The change from one to the other sometimes occurs in the same person more than once. These are therefore one disease.

647. All, it is believed, have concurred in this decision. Cullen's language is very striking: "Remit-

tentes enim, quæ dicuntur, ex eodem principio, miasmate nempe paludum, ac intermittentes, oriuntur; iisdem in locis, et eodem anni tempore, utraque simul epidemice grassatur; utraque iisdem prorsus remediis sanatur; et sæpissime in eodem homine idem, qui videtur, morbus, nunc intermittens, nunc remittens typum exhibet. Morbi idcirco, causis, sanatione, et typo simillimi, nec ad ordinem, nec ad sectionem diversam distrahendi erant.”<sup>1</sup>

648. Epidemics vary exceedingly in the violence of the two stages constituting a paroxysm of fever. In some the cold stage is very severe and long continued, and the hot stage comparatively moderate. In others, the former is almost unnoticed, while the latter is very severe. The depression is in some cases so great that the patient dies in the cold fit. In others the increased action is such that death ensues in the height of the hot stage, with symptoms of apoplexy.

The causes which produce either peculiarity in a few cases, in some years are sufficient to make it a common occurrence; just as the cause which sometimes produces a single instance, or a few cases of yellow fever, is sometimes sufficient to make it general. Thus, we have had in some counties in Virginia, in 1820 and 1821, an epidemic in which many died in

<sup>1</sup> Culleni Synopsis Nosologiæ Methodicæ, Tom. 2, p. 56. For those (fevers) which are called *remittents*, arise from the same origin as *intermittents*, viz. marsh miasmata; both rage together epidemically, in the same places, and at the same time of the year; both are cured entirely by the same remedies; and very often the self-same disease, which is seen in the same man, one while exhibits the form of an intermittent, another while of a remittent. These diseases, therefore, being very like in their causes, in the cure, and in their form, are not to be drawn asunder to different orders or sections.

the first cold stage;<sup>1</sup> and authors mention epidemic intermittent apoplexy, epilepsy, &c.<sup>2</sup>

As, in the individual instances, no one would conceive that the disease was any thing more than an aggravated degree of one or other of the stages of the prevalent fever; so, when these cases become more numerous, it would be unphilosophical to consider them different diseases, because they occur in greater numbers.

649. Both intermittents and remittents vary in violence, from an affection so slight as to be little regarded, to one so great as to acquire the appellation of malignant; and these higher degrees of morbid action take place when those circumstances, in which miasmata are produced, exist in greater force, viz. when the temperature of the atmosphere is unusually high, and moisture and filth abundant.

650. The yellow fever occurs, in hot countries, in situations, in which, in cooler countries, common remittents and intermittents would appear (436). In cool situations in hot countries, as on the elevated ridges above the places where yellow fever appears, common remittents and intermittents prevail at the very moment that yellow fever is raging below (564.) Malignant tertians become mild by removing the patient to a situation in which the cause is less powerful;<sup>3</sup> as from the neighbourhood of a marsh to a high and dry situation. On the other hand, mild cases become malignant when the sick are carried to a situation in

<sup>1</sup> Medical Recorder, Vol. 5, p. 417, by J. R. Lucas, M. D.

<sup>2</sup> Cullen. Nosol. Vol. 2, p. 49. 50. 'Tertiana carotica, tertiana epileptica. Bruce. Rees's Cyclopaedia, Sennaar.

<sup>3</sup> Lind on Hot Climates, p. 132. 133. 139.



which the cause is more powerful. Thus, Lind, speaking of Greenwich hospital in Jamaica, unfortunately built near a marsh, says, "The effects of this unhealthy situation were, that when a patient was sent thither with only a mild intermitting fever, this mild indisposition was often changed into a malignant fever, a bloody flux, or some other mortal distemper. The yellow fever often reigned there, attended with the most profuse evacuations of blood by vomiting, stools, and even by every pore of the skin, when no such symptoms occurred in patients whose cases had been similar, and who were permitted to remain in their ships."<sup>1</sup>

The same author says, "It is a common observation that those who have had obstinate agues in England or Holland, almost constantly suffer a relapse when they arrive on the coast of Africa."<sup>2</sup>

651. In the United States the yellow fever always makes its appearance in places noted for the prevalence of the ordinary autumnal fever ; and in the same circumstances which produce the latter (221. 226. 246. 252, &c. 305, &c. 309, &c. 316, &c. 320. 336, &c.) It appears only when the cause of the ordinary grade of fever is in greater force than common. The gas which produces autumnal fever being the effect of the operation of heat on moist vegetable matter, the quantity is of course proportioned to the degree of heat where the latter abounds. In very hot summers the quantity produced must therefore be greater than common, and the grade of their effect, autumnal fever, higher. This is what we find actually occurs. In the forepart of a very hot season, the

<sup>1</sup> Lind on Hot Climates, p. 131.

<sup>2</sup> Ibid. p. 54.

temperature is as high as it is in any part of common seasons; therefore in the forepart of such seasons the grade of autumnal fever is as high as the highest in common seasons; and, as the season advances, the grade advances also, and the highest grades appear.

Before the cause has acquired that degree of force necessary to produce yellow fever, bilious fever is common. It gradually becomes more and more violent, as the weather becomes more and more favourable to the production of the common cause. If from any cause the production of miasmata be checked, the violence of the fever moderates; and this moderation appears not only in the comparative mildness of the new cases, but often in the melioration of the symptoms of the old. This change takes place whether the check proceed from frost, from cool weather without frost,<sup>1</sup> or from effectual draining, or filling up ponds, as occurred at Gallipolis<sup>2</sup> and at New-York (226. 228); the effect on the fever being the same from lessening the force of the cause on the spot, as from removing the sick to a place where it exists in less force (650).

652. In the rise of the epidemic, the nature of the fever becomes a subject of warm contention; some declaring it yellow fever, others asserting it is only the ordinary fever rendered more malignant by the in-

<sup>1</sup> C. Caldwell, M. D. now Professor of the Institutes of Medicine, &c. in the Transylvania University, in a letter to the editor of the New-York Medical Repository, vol. 7, p. 149, respecting the yellow fever of 1803 in Philadelphia, says, "After the tenth of October the disease was no longer spoken of as a thing dangerous or alarming; and before the twentieth there was scarcely a case of it existing in the city. Contrary to the experience of former years, it terminated entirely before the occurrence of black frost."

<sup>2</sup> Potter's Memoir, Medical Recorder, No. 4, p. 528.

creased heat of the weather. At length, however, all admit it is the yellow fever.

Even after this is universally admitted, at a little distance from the chief sources of miasmata, even in the higher parts of the same city, cases of the ordinary grades of bilious fever are common.<sup>1</sup> Nay, it is impossible to decide in the first hours of an attack, whether the disease is of the ordinary grade of bilious fever, or will turn out to be yellow fever; many cases of the latter ending in the former, after a violent commencement; and many pronounced ordinary bilious fever terminating with all the symptoms of malignant yellow fever.<sup>2</sup>

Not only do both exist at one time, under the operation of one cause, in different parts of the same city, but of those in the very heart of the most sickly part, some have only the ordinary grade of bilious fever; and this is sometimes the case even with nurses who have attended some of the worst cases: they have been carried sick from the bedside of the dying, and have had nothing more than an ordinary bilious fever.<sup>3</sup>

<sup>1</sup> Dr. Caldwell, in the same paper, says, "As the fever receded from the low ground and malignant atmosphere of Water-street, it became more and more mild and manageable; till its evanescent shades in Second-street were, in many instances, much lighter than the common remittent of the country."

Rush, in one of his volumes, speaks of a physician, Dr. Sayre, vol. 4, p. 31, who had but fifteen cases of the yellow fever in one of the years in which it prevailed in Philadelphia, and accounts for it by observing that his practice did not extend to *that part* of the city in which the disease prevailed.

In 1821, in Alexandria, those who lived in the high and dry parts of the town seemed to be perfectly easy. No cases occurred in those parts except in one spot stated elsewhere (340).

<sup>2</sup> Rush's Works, Vol. 4, p. 79. 86. 88. Potter's Memoir.

<sup>3</sup> A case of this kind was reported regularly, and published in one of the numbers of the New-York Evening Post in the fall of 1822. Simi-

Throughout the whole course of the epidemic, warm disputes often occur respecting the nature of particular cases; plainly showing not only the impossibility of making any intelligible distinction between them except the grade; but, as grades are almost as numerous as the cases of fever, even of fixing upon that grade which shall bear the name.

653. In the country, as in the cities, when the circumstances productive of the cause of autumnal fever are in great force, the fever becomes malignant, and cases often occur not to be distinguished from the yellow fever. Dr. Potter has in his memoir on contagion given some cases. We have ourselves seen in the country cases more malignant than such as have been shown to us as yellow fever; death occasionally taking place in twenty-four or forty-eight hours from the attack. There is no recorded symptom of yellow fever that does not occasionally occur, in some years frequently, in the epidemics of the country, in the neighbourhood of marshes, ponds, and rivers. A patient of mine in the fall of 1824, who had formerly had the yellow fever, was struck with the sameness of the symptoms and appearance with those which occurred on the former occasion. In every considerable epidemic, cases occur with more or less of the following symptoms; petechiæ, hemorrhages from the gums, stomach, bowels, and a black discharge which does not stain yellow, but, on being shaken about in a white vessel, part adheres to the sides with the precise ap-

lar to this is the fact, that natives of hot climates have bilious remittent fever of a mild grade, under the operation of the same cause, and at the same moment that strangers have yellow fever.

pearance that coffee grounds treated in the same way would produce; together with excessive vomiting from the beginning, without discharging any thing but what happens to be swallowed; a burning pain in the stomach; black or purple blood, and a deep yellow or dark brown colour of the skin; coma, or delirium; and before death, perfect coldness of the limbs, of which the patient is often not sensible, sometimes for forty-eight hours, and after death, livid marks about the abdomen and back.

654. A family of twelve persons occupied a dwelling-house on Mill-creek, a branch of the Juniata river, in Pennsylvania, in 1805. The summer was very dry, the waters extremely low. All but one of the family were ill, five died, and in three of the latter, for several days before death, blood “oozed out from the extremities of the vessels through the cuticle, and stood in minute drops all over the face, chest, arms, &c. and when wiped off, no traces from whence it issued could be discovered by the closest inspection; but after death, a small livid spot appeared wherever there had been any exudation of the sanguineous fluid.”<sup>1</sup>

I have often endeavoured to discover the part of the mouth from which the blood exudes in autumnal fevers, but without success. It appears to flow into the mouth from all parts as the saliva does.

655. Cases of autumnal fever, with black vomit, have frequently occurred in the country and the smaller towns.<sup>2</sup> The following case occurred near Winchester in the summer of 1826. The account was given to me by an eye-witness. There was a

<sup>1</sup> Medical Repository, Vol. 10, p. 1.

<sup>2</sup> Ibid. Vol. 8, p. 374.



chill and fever, with extreme restlessness throughout; continual fever; death occurred at the close of the twelfth day; the body was much swelled; was perfectly black; a dark bloody fluid ran out of the nose, mouth, and eyes; and there was so much in the coffin that it ran out through the joints.

656. Physicians who have had an opportunity of seeing the yellow fever in the cities, have declared it to be the same disease with the severe autumnal fevers of the country. Dr. Speed of New-Orleans, in a letter to Dr. Mitchell of New-York, says he is fully persuaded from observations made in Washington city, in Norfolk, in Kentucky, in New-Orleans, from 1795 to 1802, that the yellow fever is but a higher degree of the common autumnal fever of the country.<sup>1</sup> Many physicians have made similar declarations<sup>2</sup> (221. 233 to 285. 387).

657. The identity of the yellow fever and the common autumnal fever is further shown by the fact, that when the yellow fever prevails in the cities, the common autumnal fever in the country, as well as in the cities (652), is very prevalent and of a very high grade; showing the operation of a cause general in its action, as in 1793 (149. 338. 404), and in 1821 (329 to 336).

Moreover, such cases as have of late years been called yellow fever have often occurred in the cities. Dr. Ramsay says they have occurred in several summers in Charleston when the yellow fever was not epidemic.<sup>3</sup> Dr. Prioleau, who had long practised in

<sup>1</sup> Medical Repository, Vol. 9, p. 259.

<sup>2</sup> Potter's Memoir, Medical Recorder, No. 4, p. 530.

<sup>3</sup> Medical Repository, Vol. 4, p. 217.

the same city, informed Dr. Dickson that no summer passed in which he had not seen such cases.<sup>1</sup> Dr. Warren, of Boston, made a similar statement (221). These severe cases were treated like the rest, and now, that a new name is given them, the impossibility of distinguishing them remains. Dr. Dickson, in his account of the yellow fever in Charleston, in 1817, says, "At the beginning of the attack, every physician, however great his intelligence, was often liable to be deceived. Hence, it became at last the general rule, to treat all cases, attended with any the slightest suspicious circumstances, as yellow fever, and it was impossible to devise a better mode of conduct."<sup>2</sup>

658. This identity is farther shown by the fact, that each at times assumes in its course the form of the other. Dr. Ramsay, in his account of the yellow fever of 1804 in Charleston, South Carolina, says, "Neglected intermittents frequently terminated in the yellow fever." "Several cases of clearly marked yellow fever terminated in low nervous fevers,"<sup>3</sup> &c. This has been observed frequently (652).

Pringle gives an extract from a communication made him by Dr. Huck, who was engaged in the English expeditions against the French and Spanish West Indies, about the middle of the last century, which very strongly confirms this doctrine. "Even in the most ardent and worst kinds of the yellow fever, I think a paroxysm may generally be perceived once in four and twenty hours; for the patient is commonly worst towards the evening, or at night. And

<sup>1</sup> Philadelphia Journal, &c. No. 6, p. 264.

<sup>2</sup> Ibid. No. 6, p. 252.

<sup>3</sup> Medical Repos. Vol. 8, p. 365. See Med. Record. No. 4, p. 536.

if the yellow fever was to be distinguished, in its beginning, from the common remitting or intermitting fever which was so fatal to our army, it was only by all the symptoms running higher, and by a greater degree of the fever when one might have expected freer remissions. Both fevers began with nearly the same symptoms; sometimes, though rarely, with a shivering. But whenever the fever ran high with burning heat, violent pains of the head and loins, profuse sweats without relief, redness and burning pains of the eyes, inflamed countenance, watchfulness, anxiety, oppression and burning pains about the *præcordia*, frequent vomitings of green or yellow bile, or (what I think was rather worse,) a constant retching to vomit without bringing up any thing, or vomiting the drinks only, one might then almost certainly foretell the yellowness; and if this appeared on the second, third, or fourth day, the disease was generally mortal. I have often seen patients labouring under most of these symptoms immediately relieved by early evacuations, and the fever brought to intermit. Nay, I have more than once seen this fever with all these symptoms carried off by bleeding and exhibiting, within a few hours from the first attack of the disease, a medicine which operated pretty briskly both by vomit and stool; and I have known some of these very patients, who were so well as to go abroad on the second or third day after, and who continued well for four or five days, but on committing some error, such as exposing themselves too much to the sun, were again seized with the same symptoms, and died on the fourth or fifth day, with their skin tinged of a deep yellow or copper colour.

Hence I am apt to think that these are different degrees of the same disease, and that it sometimes depends upon the manner in which the patient is treated in the beginning, whether he shall have the yellow, or only a remitting or intermitting fever."<sup>1</sup>

659. Here we see the common autumnal fever and the yellow fever rage together epidemically, in the same places, and at the same time of the year; both are cured entirely by the same remedies; and very often the self-same disease, which is seen in the same man, one while exhibits the form of a common intermittent or remittent, another while that of the yellow fever. The diseases, therefore, being most similar in cause, form, and mode of cure, ought not to be drawn asunder to different orders or sections (647).

660. In autumnal epidemics, nausea and vomiting are common symptoms. In some cases they are excessive. They are often accompanied by purging; and in many instances after some vomiting, the nausea goes off, and the purging remains alone. These affections are called cholera and diarrhœa. They are, however, only aggravated degrees of single symptoms, common, with many others, to these, and the great mass of cases in which only the usual degrees of these symptoms occur. To call them, therefore, different diseases, would be just as reasonable as to consider the pain in the head or back, when particularly severe, as different diseases.

661. In many cases the purging becomes more and more frequent and painful, and the discharges from the bowels smaller and smaller; and these symptoms,

<sup>1</sup> Pringle on the Diseases of the Army, p. 197, note.

if neglected, sometimes continue until the efforts to discharge become almost incessant and intolerable, and, the contents of the bowels being entirely evacuated, the most violent exertions only discharge the mucus of the lower end of the intestines, generally mixed with blood. In some cases, throughout the disease a portion of green acrid bilious matter is discharged, mixed with the blood and mucus. Scybala are not more frequent in these, than in the mass of cases that occur at the same time, in which tenesmus is not present. This distressing affection has also acquired a distinct name, dysentery, but is not a distinct disease.

662. These affections of the stomach and bowels are met with in epidemics of every grade, and occur in the same places, and at the same time, with those cases in which the stomach and bowels are not much affected. Each occasionally assumes the form of the others, and, like the other symptoms of autumnal fever, suffers a periodical remission and exacerbation. Of this there is an abundance of evidence in the best authors.

663. Cholera morbus, diarrhœa, dysentery, and tertian fever, are every where mentioned as occurring together in Cleghorn's account of the diseases of Minorca. He says, "And the extraordinary heat of May ushered in *the summer diseases* somewhat sooner than usual. For about the end of that month the cholera morbus carried off many children, and in June the tertians became universal. Besides, towards the end of June, the diarrhœa, dysentery, and tenesmus, broke out and raged violently for some weeks."<sup>1</sup>

<sup>1</sup> Cleghorn's Obs. on the Diseases of Minorca, p. 130. See the whole second chapter for similar statements. Phil. Jour. &c. No. 6, p. 250, 251.



664. "The cholera morbus sometimes hath its regular periods, like a tertian, as the paroxysms of tertians are frequently attended with a cholera. Sometimes a tertian is changed into a dysentery; or a dysentery becomes a tertian; and when one of these diseases is suppressed, the other often ensues; nor is it uncommon for dysenteric fevers to put on the form of tertians; and for the fits of tertians, to be regularly accompanied by gripes and stools."

665. "It is remarkable that both dysenteries and tertians, without any manifest cause, are sometimes more universal and severe in one part of the island in one year, than another; and often seem, as it were, to attack particular families with uncommon severity; whilst others in the same place, the same circumstances and way of life, escape. Those, however, who live in low vallies, or near stagnating corrupted waters, are commonly the greatest sufferers."<sup>1</sup>

666. In his account of tertian fevers he says, "Sometimes one or two symptoms of the fit predominate with such violence that the rest are obscured, or altogether eclipsed. Hence we so frequently meet with hemi-cranias, choleras, dysenteries, and chincoughs, returning regularly at stated periods."<sup>2</sup> He speaks of cholera morbus occurring in tertian fever;<sup>3</sup> of tertian fever terminating (as Hippocrates tells us) in dysentery, &c.;<sup>4</sup> and says that fevers, in the course of which vomiting, purging, bleeding of the nose, colliquative sweats, or the like come on, "sometimes are immediately changed into mortal dysenteries; sometimes they

<sup>1</sup> Cleghorn's Observations on the Diseases of Minorca, p. 123.

<sup>2</sup> Ibid. p. 146.

<sup>3</sup> Ibid. p. 151.

<sup>4</sup> Ibid. p. 155.

become continual tertians, and run out to a great length,"<sup>1</sup> &c. Speaking of relapses he says, "It is not uncommon for a looseness to come on in the room of a relapse."<sup>2</sup> He says dysenteries begin in three ways, like a simple diarrhœa,<sup>3</sup> or with a fever,<sup>4</sup> or a griping:<sup>5</sup> but in which ever way they begin, "in process of time, the case comes to be pretty much the same."<sup>6</sup>

667. Speaking of the cure of cholera, Cleghorn says it must be managed according to the method of Hippocrates, lately described more fully by Sydenham, by anodynes, &c.; but "if feverish complaints, or fixed pain in the belly or sides come on, after the evacuation is stopped, (as is frequently the case) it will be necessary to bleed and keep the belly open."<sup>7</sup> He had said before, speaking of tertians, cholera, and dysentery, that if one is suppressed, the other ensues (664); and this treatment is well adapted to the cure of a fever. He also says, "When the cholera morbus returns periodically, like a tertian, it must be cured as these fevers are,"<sup>8</sup> &c.

668. Speaking of the cure of dysentery, he says, "When they begin like a simple diarrhœa without fever or fixed pains in the belly, the first thing to be done, is to empty the intestines of their acrimonious contents as soon as possible,"<sup>9</sup> &c. But when the dysentery began with a fever, or with a griping (666), he "confided principally in the early use of the antiphlogistic method," bleeding repeatedly, and using

<sup>1</sup> Cleghorn's Observations on the Diseases of Minorca, p. 158.

<sup>2</sup> Ibid. p. 214.

<sup>3</sup> Ibid. p. 225, 229.

<sup>4</sup> Ibid. p. 225.

<sup>5</sup> Ibid. p. 226.

<sup>6</sup> Ibid. p. 227.

<sup>7</sup> Ibid. p. 223.

<sup>8</sup> Ibid. p. 224.

<sup>9</sup> Ibid. p. 229.

emollient injections, and fomentations, and plenty of mild diluent drink, shunning opium as much as possible.<sup>1</sup> As soon as the fever was somewhat abated, he endeavoured to procure discharges from the bowels; first by the gentlest cathartics, and “*proceeding by degrees to the more active, till the end proposed be obtained.*”<sup>2</sup> He says, “The great similitude there is in many respects between tertian fevers and dysenteries, induced me frequently to make use of the bark in the last named disease; when the fever and gripes were regularly exasperated, either every day or every other day at stated periods, it has often effectually put a stop to both,”<sup>3</sup> &c. Here we see dysentery and many cases of cholera morbus treated in the same manner with tertian fever.

669. Sydenham speaking of the epidemics of London, says, “This fever, which had continued the whole year, made great devastation in the beginning of July, 1675, but at the approach of autumn it began to strike in upon the bowels, appearing sometimes with the symptoms of a dysentery, and at others with those of a diarrhœa; though sometimes it was free from both, and rather seized the head, and caused a kind of stupor.” He further says, “the gripes were generally supposed to have destroyed the numbers that died at this time, whereas in reality their death was rather to be ascribed to the fever, for such as attended the sick during this autumn knew how much the fever prevailed; so that both the dysentery and the diarrhœa ought rather to be accounted *symptoms*, than *essential* and *original* diseases.”<sup>4</sup>

<sup>1</sup> Cleghorn's Observations on the Diseases of Minorca, p. 231.

<sup>2</sup> Ibid. p. 232.      <sup>3</sup> Ibid. p. 236.      <sup>4</sup> Sydenham's Works, p. 201.

670. Morton's evidence is to the same amount. He says in the autumn of 1666, that, with the autumnal fever, diarrhœa and dysentery were very prevalent; and that "a remission and exacerbation of the gripings, looseness, and other tormenting symptoms, were plainly observed to return duly on every other day." Whence (he says) he clearly discerned that these were but symptoms, and the fever was the primary disease.<sup>1</sup>

671. Pringle says, "'The bilious disorders begin about the decline of summer, and become epidemic in autumn, appearing earlier, more general, and with worse symptoms, in proportion to the heat of the season, and to the moisture of the ground and climate. Although of different forms, they are of a like nature, and may be reduced to two heads, viz. fevers and fluxes.'" <sup>2</sup>

"The heat and moisture of the air appear to be no less the chief remote and external cause of the dysentery, than of the autumnal remitting and intermitting fevers," <sup>3</sup> &c.

"Hitherto we have seen how similar the causes are of the remitting and intermitting fevers, and of the bloody flux. Nay, the affinity extends even to the occasional or exciting causes. For in the end of summer, or in autumn, when any number of men are exposed to night damps and fogs, especially after a hot day, or lie upon wet ground, or in wet clothes, part of them will be seized with that kind of fever, and part with this flux; and perhaps a third sort will have a disorder compounded of both. Add to this, that those

<sup>1</sup> Medical Repository, Vol. 1, p. 53.

<sup>2</sup> Pringle on the Diseases of the Army, p. 168.

<sup>3</sup> Ibid. p. 251.

fevers begin to be frequent in camp whilst the dysentery still subsists; that the first symptoms are often similar, such as the rigors and disorder of the stomach; that the remitting and intermitting fevers of a more malignant kind have sometimes ended in a bloody flux; that such countries as are most subject to these autumnal fevers, are likewise most liable to the dysentery; and that the analogy continues even as to the method of cure, in so far as the principal part of it consists in clearing the *primæ viæ*.”<sup>1</sup>

672. Of the people who were for months shut up in the ships *Hankey* and *Calypso*, at the island of *Bulama*, on the coast of Africa, “Some had regular intermittent fever of various continuance, from a few weeks to several months: others had a violent fever, which terminated favorably or fatally in one, two, three, four, five, or six days; or, which lingered out, after its first violence, as many weeks: some had diarrhœa and dysentery, &c. and all these varieties happened on board the same ships, without any obvious difference in the exposure of the individuals to the causes of disease. Yellowness of the skin was a common appearance in the sick; and some of those who died at *Sierra Leone* (on their way to England) had black vomit; and this symptom also appeared at *Bulama* in the latter part of the season.”<sup>2</sup>

673. Dr. Hildreth, in his account of the epidemics of 1822, 1823, in *Marietta, Ohio*, says, “In the months of September and October, dysenteries were very prevalent; and in many instances, alternating with intermitting fever in the same subject.”<sup>3</sup>

<sup>1</sup> Pringle on the Diseases of the Army, p. 253.

<sup>2</sup> Med. Repos. Vol. 1, p. 475.    <sup>3</sup> Philad. Jour. &c. No. 17, p. 113.



Dysentery often commences with symptoms of diarrhœa, as almost every physician has experienced.<sup>1</sup>

674. Dysentery corresponds in grade with the fever which it accompanies. In the cooler regions of the earth it is comparatively mild; in the tropical regions, where fevers are of the highest grade, it is a mortal distemper (650). In this climate, where fevers under the influence of an unusually hot sun are sometimes highly malignant, the symptoms of dysentery correspond. "In the summer of 1797, (says Dr. Potter,) at Baltimore, the symptoms of dysentery were gradually commuted for those of a yellow fever of the deepest die. From the middle of June until the last of July, a time of intense heat and reiterated torrents of rain, the dysenteric form of fever pervaded Fell's Point. In August, the rains having ceased, and the weather continuing unusually hot, the dysenteric symptoms failed until they were lost in the unequivocal characters of the yellow fever."<sup>2</sup>

675. The cholera infantum is the cholera morbus of children. The distinction implied in the term, *infantum*, is of late date. It is not used by Sydenham, Boerhaave, Cleghorn, or Cullen. Sydenham mentions children being affected by *cholera morbus*. Cleghorn does the same repeatedly; thus he says, "about the end of that month the *cholera morbus* carried off many children."<sup>3</sup> Boerhaave in his Aphorisms, and Cullen in his First Lines, do not mention children at all in their account of cholera; whence it is evident they in-

<sup>1</sup> Currie's Medical Reports, p. 261.

<sup>2</sup> Potter's Memoir, Medical Recorder, No. 4, p. 537.

<sup>3</sup> Cleghorn's Observations on the Diseases of Minorca, p. 130.

tended to include the vomiting and purging of children under the general title of cholera morbus.

676. The cholera appears in situations favourable to the production of autumnal fever. The cities of the south are more subject to the ravages of autumnal fever than those of the north. The same is true respecting the prevalence of cholera infantum. Those cities which from their low and marshy situation are remarkably subject to the former, are likewise to the latter. In cities, those parts most favourable to the production of fevers, such as dirty alleys, and filthy suburbs in the neighbourhood of marshy inlets, wet places produced by regulating streets, &c. are also most productive of cholera infantum. If a city by cleaning and draining be preserved from the former disease, it is likewise from the latter. In one quarter of the town of Winchester, a few years ago, there was a large pond made by regulating the streets, &c. (375). In the autumnal season there was a great number of cases of fever, and of cholera infantum, in the immediate neighbourhood of the pond. It was filled up, and since that time there has been very little of either in that quarter. When the whole town was little better than a marsh, numbers of children died of bowel complaints (372). Since it has been rendered dry by draining and filling up with stones and earth, it has become more healthy.

This disease appears also in the country, in places favourable to the production of autumnal fever; as about mill-ponds, near water courses, marshes, and low grounds. Country air is recommended by the physicians in cities to children in this disease, and it

is advantageous to them if the air of the place to which they are carried be purer than that of the city ; but if the place of their retreat be near marshes, they are not benefited by the change. Dr. Rush says that two out of the only three patients he ever lost, of those who were sent into the country, were carried into the impure air of the marshy neck below Philadelphia.

In the island of Minorca, noted for the annual prevalence of autumnal fever of high grade, the cholera infantum also regularly makes its appearance. Cleg-horn mentions the occurrence of this disease in every year which he spent in that island.

677. Cholera infantum and autumnal fevers both appear in hot weather. If the weather be temperate, they are both moderate ; if hot, they are both aggravated. If hot weather come sooner than common, they both appear earlier than usual. When the weather becomes cold, they both decline.

In cities in which bilious fevers of high grade annually prevail, children are in such danger from cholera, that great numbers are carried into the country, to spend in a pure air the time during which the autumnal fever prevails ; and they cannot be taken back with safety until that time be past. If they return during that period, they are in danger of an attack of cholera, or of a relapse, just as those adults who return prematurely are of an attack of fever.

678. Dr. Jackson, in his account of the malignant or yellow fever of 1820, in Philadelphia, says, " In the past summer and autumn, diseases assumed the general symptoms which they possessed in the former epidemic periods of 1793, 1797, 1798. Cholera morbus

and infantum were very prevalent ; bilious and remittent fevers, from which our city had been for several years nearly exempted, were common diseases ; and dysentery, which had become a rare disease in Philadelphia, was of frequent occurrence, and very difficult to manage.”<sup>1</sup>

679. Dr. Rush, in his inquiry into the causes and cure of this disease, says, “ Its frequency and danger are always in proportion to the heat of the weather.” This is said respecting its prevalence in the city of Philadelphia ; and it is ascertained, from observation of the thermometer during twenty-five summers (404), that, in that city, the frequency and danger of autumnal fever also, is proportioned to the same circumstance, the heat of the weather.<sup>2</sup> Both these forms of autumnal disease are, in that city, the effect of the miasmata produced by the action of heat on the extensive low grounds of the Neck.

On the contrary, in elevated and dry countries neither remittent fever nor cholera infantum appear, unless there be some wet weather. This I have constantly experienced in a remarkably elevated village and neighbourhood in which I resided for some years.

680. Cleghorn, in his account of the diseases of Minorca, says that the young children, towards the end of June, are attacked with *vomiting, purging, and periodical fever*, and in July tertian fevers appear among people of all ages.<sup>3</sup>

681. In 1745, “ June was scarce ended when *the tertian fevers and cholera morbus* began, and increa-

<sup>1</sup> Philadelphia Journal, &c. No. 2, p. 319.

<sup>2</sup> Med. Record. No. 1, p. 140. <sup>3</sup> Cleghorn's Observ. &c. p. 121.

sing daily according to custom, came to their greatest degree of frequency in September; from which they gradually declined,"<sup>1</sup> &c.

682. In 1746, "The chincough had no sooner disappeared than a *periodical fever, accompanied with vomiting and purging*, took its place, which proved alike fatal to many children during the summer."<sup>2</sup> "In July the tertian fevers broke out as usual, and their violence being augmented by the excessive heat of the season, many persons died suddenly about the seventh day of the distemper; but the cold weather of September prevented their becoming so general and continuing so long as they commonly do; for about the end of October they gave way to catarrhs and quartan agues."<sup>3</sup>

683. In 1747, "*The extraordinary heat of May* ushered in the summer diseases somewhat sooner than usual. For, about the end of that month the cholera morbus carried off many children, and in June the tertians became universal. Besides, towards the end of June the diarrhœa, dysentery, and tenesmus broke out and raged violently for some weeks."<sup>3</sup> Here observe the cholera commenced a month earlier than common, as did also the tertians, diarrhœa, and dysentery.

684. "The ensuing summer (1748) proved very unhealthy to the children, many of them dying of the cholera morbus, and periodical fevers," &c. "The tertians began in July and finished their annual career about the end of November; many persons died suddenly during the dog-days and about the equinox. In

<sup>1</sup> Cleghorn's Observations on the Diseases of Minorca, p. 127.

<sup>2</sup> Ibid. p. 129.

<sup>3</sup> Ibid. p. 130.



the mean time dysenteries prevailed in Ciudadella,<sup>1</sup> &c. The month of July in this year was extremely hot and sultry.<sup>2</sup>

These quotations strikingly show not only the general dependence of tertians and of cholera morbus on the same kind of weather, but the intimate connexion of both with its variations.

685. It has been argued that the same cause cannot produce both cholera and autumnal fever, because the former appears somewhat earlier in the season than the latter.

In answer, it may be observed that the tendency of the *argument*, founded on the appearance of the fever and of cholera in the same situations, and in the same kind of weather, is to show, that both depend on a common cause arising out of those circumstances; and that the force of the *objection* rests on the presumption, that, as the fever appears later than the cholera, the cause of the fever could not have existed when the cholera commenced, or it would likewise have produced the fever. The truth, however, is, that miasmata, the cause arising out of the circumstances above-mentioned, are produced before the appearance of either autumnal fever or cholera. The first warm weather occasions an evolution of gas from moist and filthy spots. It is stated by Dr. Jackson, in his account of the fever in 1820, in Philadelphia, that bubbles of air were seen constantly disengaging from the half fluid mud in some of the confined alleys of that city as early as in May. The *argument*, therefore, is sustained; and the force of the *objection* falls before

<sup>1</sup> Cleghorn's Observations, &c. p. 133.

<sup>2</sup> Ibid. p. 110.

the fact, that the cause of autumnal fever exists before the appearance of cholera infantum; while the dependence of both on the same cause, miasmata, is shown by the correspondence of both, in the number of cases and in grade, with the increasing power of that cause, as the season advances, or when it is hotter, or when it comes earlier than usual' (678).

686. The correctness of this view of the subject is further shown by the occurrence of autumnal fever in some children, at the same time that others have cholera. Cleghorn speaks of many children dying of cholera morbus and periodical fever. Some have "vomiting, purging, and periodical fever" (680), or "a periodical fever accompanied with vomiting and purging" (682); while others have a periodical or remittent fever, without either (684); all of which every physician of experience must have had many opportunities of observing. The occurrence of remittent fever in children, with or without disordered stomach and bowels, shows the presence of the cause of the common autumnal remittent fever; unless it be shown that remittent fever in a child is a different disease from remittent fever in an adult; or, that a remittent fever accompanied by disordered stomach and bowels, is a different disease from a remittent fever which is not so accompanied.

The whole difficulty consists, therefore, in the fact, that children are more easily affected than adults; but this is not always the case, the tertian fever of adults and cholera infantum sometimes making their appearance at the same time (681).

<sup>1</sup> Philadelphia Journal, &c. No. 6, p. 250. 251.

687. In cholera infantum there is a regular febrile exacerbation in the evening. Generally the fever only remits, but in the autumnal season of 1821, when almost every fever in my practice was an intermittent, in cholera also there was a stretching and coldness of the surface. Dr. Rush says, since the prevalence of the yellow fever in Philadelphia, the cholera infantum requires bleeding to cure it, in some cases as often as twice or thrice. Cleghorn also mentions that the cholera is accompanied by a fever (680. 682. 684).

Sometimes the diarrhœa ceases, and the fever then increases considerably; and if the former return, the latter moderates again. In the former case the disease is not to be distinguished from a common autumnal fever; and in both, there is as complete a conversion of one into the other, as in the case of the remittent and intermittent (647). I have also seen dysenteric symptoms appear in cholera, so marked that the case was pronounced dysentery by one who had not seen the patient before.

688. My own experience corresponds entirely with the preceding. All these affections arise in the same circumstances, of season and situation, and are found continually prevailing together. Few epidemics are entirely without cases with dysenteric symptoms. In some seasons, they occur in the great bulk of the cases. The autumnal fever often commences with such symptoms. Sometimes they are not so considerable as to give name to the disease;<sup>1</sup> at other times they become more and more severe, and attract the chief attention of the patient and the physician, and the disease as-

<sup>1</sup> Pringle on the Diseases of the Army, p. 64.

sumes the name of dysentery. The symptoms are still, however, the same with those of autumnal fever, except the griping and tenesmus; but these afford no better foundation for making it a distinct disease than the vomiting does. The sole difference is, that in the former the lower part of the intestinal canal is principally affected; in the latter, the upper part. In the extreme cases of the former, dissections show that the lower end of that canal, from the cœcum to the rectum, is purple or black;<sup>1</sup> in those of the latter, the upper end is affected in the same way; while the whole tract is more or less in like manner affected in both the former and the latter, in common with the great bulk of the cases which occur in company with them. If the mere difference of the part affected constitute a different disease, we must have more names introduced into the nosological list. In June, 1825, I had three cases of dysentery, that is, with the symptoms, nausea, griping pain, small discharges, bilious, mucous, and bloody; and on the administration of mercurial cathartic medicines, there were dark, green, or black passages, followed by entire relief. At the same time there were three cases of nausea, griping pain high up in the intestines, and no discharges; but on the administration of similar medicines, there were similar discharges, followed also by entire relief. In these different cases the only difference was the part affected with griping pain. Sydenham has two passages which show that the same had often occurred in his practice.<sup>2</sup> Dysenteric symptoms sometimes come

<sup>1</sup> Pringle on the Diseases of the Army, p. 245.

<sup>2</sup> Sydenham's Works, Sec. 4, ch. iii. 1. 7.

on in the progress of a fever, and the disease would of course be called dysentery, by one who had seen it for the first time in that stage (687). Sometimes when the case is taken early, and well treated with mercurial cathartics, the affection scarcely arises to such height as to acquire the name; or even if considerable, it is quickly removed, and from that time no person can possibly distinguish the disease from the common autumnal fever by any existing symptom.

689. The same in substance is true of the cholera and diarrhœa. In 1825, among other cases in the autumnal epidemic, a woman who had been almost continually vomiting for four days, was bled and took twenty grains of calomel, and after a few hours some doses of scammony. She did not vomit after that day, and the case progressed precisely as the other cases did, and were not to be distinguished from them.

In another season a man had about twenty passages in one day. He took twenty grains of calomel; the discharges became black, consistent, and were reduced to a small number, and the progress of the case was the same with other cases of autumnal fever; the symptom, diarrhœa, having entirely disappeared. These are instances of cases which frequently occur.

690. All these forms of disease therefore, cholera, diarrhœa, dysentery, and tertian fever, arising from the same origin,<sup>1</sup> prevailing together in the same places,<sup>2</sup> and at the same season of the year,<sup>3</sup> being cured by the very same remedies,<sup>4</sup> and very often the same dis-

<sup>1</sup> 665. 671. 672. 673. 676.

<sup>2</sup> 663. 671. 672. 673. 676. 678. 680 to 684.

<sup>3</sup> 663. 665. 666. 669. 671. 672. 673. 677. 680 to 684.

<sup>4</sup> 667. 668. 671.



ease in the same man, one while exhibiting the form of one, and another that of another of them ;<sup>1</sup> and being therefore most similar in cause, in form, and in the cure, ought not to be separated and classed as different diseases (647).

691. It appears from the preceding pages that weakened action of the heart is the effect, directly or indirectly, of the remote causes of fever. This, therefore, is a link of the chain of causes and effects extending from the remote causes to the symptoms of fever (18). This conclusion is confirmed by the fact long since ascertained, that all fevers are preceded by weakened action of the heart.<sup>2</sup>

692. We have inferred the identity of all the forms of autumnal fever from the identity of the remote cause (644, &c.). It is a fair inference, that a cause, operating on beings constituted alike, produces effects in every part of the world of the same nature ; and, when we perceive *differences in grade only*, that they are to be attributed to difference in the *force of the cause*, or in its power over individuals arising out of constitutional difference ; particularly when we perceive all the varieties which exist in the different epidemics of the earth, produced in every epidemic, in every country.

693. We infer the same from observing that this remote cause, although in different climates and circumstances of various degrees of force, operates, in all pla-

<sup>1</sup> 664. 666. 669. 671. 673. 674. 685. 650.

<sup>2</sup> Boerhaave's Practical Aphorisms, 563.

Cullen's First Lines, xxxiv. xlv.

Darwin's Theory of Fever, Supplement, 1. 1. 6.

Rush's Works, Vol. 3, p. 3. 4.

ees alike, in producing the effect, weakened action of the heart (691). This identity of effect in all, unquestionably shows that the remote cause is operating alike in all, and confirms us in the belief that its ultimate or remote effects, the symptoms constituting the disease, will be the same.

694. We infer the same from the identity, in all these fevers, of this new cause, weakened action of the heart, produced by the same remote cause. If we infer identity of the ultimate effects from the identity of the remote cause, and the justice of the inference is confirmed by observing that it is so far correct, we more confidently infer their identity from the identity of a cause nearer than the remote cause.

695. It may perhaps be objected to this inference, that weakened action of the heart precedes variolous fever also, and therefore the identity of the autumnal fevers cannot be inferred from their being all preceded by this state of the system. It is replied, that weakened action of the heart uniformly produces certain effects called fever (691). Even when this cause is produced by a peculiar remote cause, the variolous virus, it produces its proper effect, fever, modified by certain effects peculiar to the remote cause. As weakened action of the heart, produced by *this* remote cause, uniformly produces corresponding effects, a fever *sui generis* ; so, when produced by another remote cause, miasmata, we infer it will as uniformly produce a corresponding disease. Thus, as the confluent and distinct small-pox, proceeding from one remote cause, the mildest following inoculation with virus procured from a case the most malignant, are one disease ; so.

fevers, the mildest and most malignant, proceeding from one remote cause, miasmata, are also one.

696. We infer the same identity from observing that the degree of the symptoms is proportioned to the degree of the remote cause : as the latter, in proportion to the advance of the season, increases in force, the former become more and more severe ; so that all the grades, from the mildest to the most malignant, are seen in one season under the operation of the same cause (651).

697. We infer the same from all the different grades appearing in all the same varieties of form, viz. intermittents, remittents, dysentery, cholera, and winter fever, or pneumonia typoides.<sup>1</sup>

698. Thus the identity of the remote cause, of the intermediate cause, and of the effects, and the proportion of the effects to the remote cause, all combined, constitute a mass of evidence incontrovertibly showing the identity of all the autumnal or hot weather epidemics.

<sup>1</sup> 644 to 687, but particularly 648 to 650. 658. 674. 678. 679. Also 608 to 622, particularly 619. 620.

## CHAPTER X.

### OF CONTAGION, CONSIDERED AS A REMOTE CAUSE OF FEVER.

699. Contagion has also been enumerated among the remote causes of fever.

700. Contagion is a matter produced by a diseased body, capable, on application to a healthy body, of producing in it the same disease, and of causing it to produce contagious matter of the same kind.

701. It is either fixed or volatile. The former produces its effect only by contact with the sick, or by inoculation; such is the vaccine virus, the syphilitic, &c. The latter produces its effect in a manner unknown, but without contact with the sick, or with any thing visibly proceeding from them.

702. As all the contagions known to produce their appropriate diseases by contact with the sick, or by inoculation, are very sure in their operation; and as contact is easily avoided, the diseases thus propagated must be very sure to affect those exposed, and at the same time must extend to very few.

703. It is evident, therefore, that diseases can be extensively and rapidly spread by volatile contagion only.

704. The contagion attributed to the plague has by some been considered as fixed. But this is entirely inconsistent with the rapid progress of that disease,

the numbers affected, and the escape of so many of those who are most exposed by frequent contact with the bodies of the sick (700. 701). The fixed contagions, moreover, take effect only when the skin of the part to which they are applied is broken, or when applied to a very delicate and moist surface: and they produce in that part a local affection, and the system is secondarily affected. It is not, however, pretended that the plague is propagated only when the skin is broken. Finally, the local affections in plague appear chiefly in those parts of the body which do not come in contact with the sick; and in a very great proportion of the cases, particularly in all the worst cases which terminate in death in a few days, do not appear at all. The plague, therefore, cannot be propagated by a fixed contagion.

Accordingly we find that the allegations of the most eminent authors respecting the plague, are founded on the idea of its spreading by a volatile contagion. The same may be observed of other epidemic diseases, as the yellow fever, and the typhus fever. It is by a volatile contagion, therefore, if by any, that these epidemic diseases are propagated, and the whole tenor of the preventive means indicate it. It is a volatile contagion, therefore, which we have in view in the following observations.

705. It may be here observed, that it follows as a consequence of the origin of hot weather epidemics, as well as of those of the winter, that they are not contagious. The propriety of that rule of philosophizing, that “more causes of natural things are not to be admitted, than are both *true* and *sufficient to explain the*



*phenomena*," will not be contested. Now, waving for the moment the consideration of the truth of the doctrine of the propagation of these diseases by contagion, it is enough, that the agent, which we have shown to be the cause of these diseases, is not only sufficient to explain the phenomena observed, but contagion is not. Dr. Caldwell in his memoirs has well observed, "that the yellow fever will in two or three weeks overrun an extent of city, which the small-pox will not pervade in twice as many months. To what cause (he continues) can such a remarkable difference be owing? Certainly to this, that the small-pox is propagated *only by contagion* from the sick to the well, a source of disease which most persons have it in their power to avoid; while yellow fever is spread by a vitiated, or what I shall here term a malignant atmosphere, which being a common medium has access to every one."<sup>1</sup> We shall not, however, rest the question on this inference alone, but discuss the subject on its own merits.

706. When a person in good health is placed near one affected with morbid symptoms, and becomes affected in the same manner, the question arises, how was the disease produced in the second?

707. If with all our care we can discover no cause; if we find that in all the varying combinations of circumstances that have occurred for ages back, the morbid symptoms in question never appeared without the presence of a person previously affected in the same way; and that they are, in every change of circumstances, the invariable consequence of being present

<sup>1</sup> Caldwell's Memoirs, p. 100.

with a person so affected; the disease appearing wherever the sick go, and never where they do not; we are led to the conclusion, that the circumstances which produce the cause, exist in the affected person, and we are induced to suppose, that the person in health is influenced by something invisible passing from the sick; and this invisible influence we call contagion. The belief in the existence of volatile contagion, is therefore *a hypothesis* resting for support on its fitness to explain the spreading of a disease, and our inability to discover any other cause. That it is no more will appear, if we consider that we have no evidence whatever of the actual existence of volatile contagion. We know nothing of it; we only infer its existence from the single circumstance of the spreading of the disease.

708. If however we find that the disease is not the invariable consequence of being in presence of a sick person; that it never follows unless this exposure be made in certain circumstances; and that in these circumstances it arises, *whenever they occur*, without the presence of the sick; we are entirely destitute of the only ground on which we can rest the hypothesis of contagion (707).

709. Further, if, in these circumstances, we at length discover a cause capable of producing the symptoms observed, heretofore invisible in consequence of being an æriform fluid; if these symptoms uniformly appear in such circumstances, that this cause must be present, and in no other, the question is at an end; *the cause of the first case is manifestly the cause of all that follow*.

710. If a disease be propagated by a volatile conta-

gion, the attendants must take it ; for if they do not, we are destitute of the only ground on which the hypothesis of contagion rests (707. 708). They must communicate it to their attendants ; these to others ; and so on, until the disease become universal.

711. The only thing which prevents this result, is a law of the system, impressed on it by the Creator, with all others necessary to the continuance of the race of man. This law is, that the system is so little disposed to be affected by volatile contagion, that, except very rarely, it produces no effect on a second application or exposure. By means of attendants exempt from its action, in consequence of having previously suffered, the communication between the sick and those in health who are still liable, is cut off, and the progress of the disease arrested. Without this restriction it would not only be universal, but perpetual.

712. It is therefore absolutely necessary to the very existence of the human race, that the volatile contagion by which a mortal disease is propagated, be incapable, in general, of affecting the same person repeatedly.

713. However weak a volatile contagion may be, if it be capable of producing sickness, the attendants of the sick must be affected ; this, as we have before stated (710), being the only ground we have for believing it to exist ; they will communicate it to others ; and so on, until it become, unless restricted as above (712) from affecting the same individual repeatedly, universal and perpetual.

714. It has been asserted that there are volatile contagions which only act in certain circumstances ;

as in the presence of foul air, or of a certain temperature. The belief in the existence of a volatile contagion so limited, must rest on the same ground with those not limited (707). If it exist, it must, through the attendants of the sick, spread until it become, unless restricted as above (711. 712. 713), *universal and perpetual in those circumstances*.

715. As there is, however, no such universal and perpetual disease, even with the limitation in the preceding paragraph, the consequence is, that all the volatile contagions *are so restricted* in their operation that they cannot affect the same individual repeatedly. From this it follows directly, that no disease *not so restricted*, or to which we are repeatedly liable, is propagated by a volatile contagion.

716. It has however been said that a volatile contagion, acting only in certain circumstances, need not necessarily affect all in those circumstances. It is not, it is said, the mere presence of foul air which gives effect to the contagion; that a change is to be effected in the body, to prepare it for the action of the contagion; that until this be done, the latter is inert; and if the system be able to resist the action of foul air, so that this change be not accomplished, the person escapes.

717. It may be answered, this change must be a morbid one; foul air produces no other; and as a morbid change in the state of the system must be followed by corresponding effects, there is *present* a cause for the morbid phenomena, the hypothesis of contagion loses its sole support, and falls to the ground (707).

718. A disease, therefore, to which we are repeatedly liable, is not propagated by a volatile contagion (715).

719. If a disease be propagated by a volatile contagion, it will spread until it become universal, unless it be stopped by insulating the sick, by means of those who are not liable to it, in consequence of having already been affected (710. 711).

720. If a disease be propagated by a volatile contagion in certain circumstances only, it will spread until all in those circumstances are affected, unless it be stopped by insulating the sick by means of those, who, having had it, are not again liable to be affected (714).

721. We shall find all these characteristics of contagion in the small-pox. 1. We are not repeatedly liable to be affected by its contagion (718); 2, it would spread universally, unless stopped by insulating the sick as above (719); 3, in persons placed near the sick, the disease is almost invariably produced; 4, it is never produced, under any circumstances, (excepting by inoculation, see 704,) without a near approach to persons affected with the disease; 5, it invariably spreads from the sick, without regard to circumstances. We therefore believe this is a contagious disease.

*Of the contagion attributed to yellow fever.*

722. It is still believed by some eminent physicians, that yellow fever is propagated by a peculiar contagion. Let us try its claim to the character of a contagious disease by the principles above laid down.

723. We are liable to repeated attacks of this disease. Dr. Rush, speaking of the yellow fever of 1793 in Philadelphia, says, "Cases of re-infection were very common during the prevalence of this fever." In the year 1794, in which there was but little of the disease,



he met with four cases, the subjects of which had had the fever in the year before.<sup>1</sup>

Dr. Potter, in his memoir on contagion, states that he has himself had this disease three times.

Mr. Doughty, a British surgeon who served eight years in the West Indies, mentions "the case of the 85th regiment, which suffered dreadfully from the concentrated form of yellow fever in Spanish town in 1805. The next season they escaped it entirely in Fort Augusta, but again in 1807 they were nearly annihilated in Kingston. At the latter time and place, Mr. Doughty himself was at the brink of the grave from an attack of the yellow fever, though seven years previously, he asserts that he had it in its concentrated form in the same town."<sup>2</sup>

Dr. Dickson, in a communication to Dr. Johnson respecting the yellow fever of 1808, in Mariegalante, says, "Many of the old, as well as the new troops were seized with the fatal fever; indeed the worst cases were second attacks."<sup>3</sup> We are then liable to repeated attacks of this disease, and therefore it is not propagated by a volatile contagion (718).

724. If the yellow fever were propagated by a volatile contagion, unless stopped by insulating the sick by means of attendants not liable to be attacked, in consequence of having once had the disease, it would become universal (719); and if propagated by a contagion acting only in certain circumstances, unless stopped as above, it would continue to spread until *all in those circumstances were affected* (720). But no

<sup>1</sup> Rush's Works, Vol. 3, p. 88. 217.

<sup>2</sup> Johnson on Tropical Climates, Vol. 2, p. 87.      <sup>3</sup> Ibid. p. 199

attempt is made to insulate the sick in this manner, no person being thus exempt from repeated attacks, and the disease does not spread until all, even in the circumstances favourable to it, are affected. Therefore, also, it is not propagated by a volatile contagion.

725. Numberless facts support this conclusion. 1. Great numbers who are near the sick, attending on them, escape the disease entirely. 2. It often is, and may at any time be produced by certain circumstances, without the presence of persons previously affected. 3. When the sick are carried out of these circumstances, or removed beyond the influence of the cause there generated, no person who approaches them is affected.

726. Great numbers who are near the sick, attending on them, escape entirely. A multitude of instances of this might be stated. The following are from Dr. Jackson's account of the yellow fever of 1820 in Philadelphia.<sup>1</sup>

727. "The family of Hays (in which occurred the first case reported to the board of health,) occupied a single room. It consisted of himself, wife, and three children, who all shared the same bed during his illness." "The other tenants of the house, the neighbours, and his acquaintance, frequently visited him while sick, and a number of persons assembled at the house to attend his funeral. Not an individual thus exposed, sickened," &c.

728. A rigger contracted the disease at Walnut-street wharf, sickened and died. Two families occupied the house, the individuals of which had to pass through where this man lay sick, in going in and out

<sup>1</sup> Philadelphia Journal, &c. No. 3, p. 25.

of the house. The neighbours also were frequently with him. No one took the disease from him, though the alley was at that time very filthy and offensive.

729. Another man, who took the disease at the same wharf, had a family of ten persons. The alley in which he lived is narrow, confined, and filthy; the house small and close. No one of the family or neighbours, however, were affected.

730. In the case of a lad, who lay in a garret with a single window, the disease displayed the worst features of malignity. Seven or eight persons were almost constantly employed in the room with him, and the night previous to his decease, some one of them was incessantly occupied in frictions of his body. No sickness appeared among them. There are more instances to the same amount in that paper.

731. Dr. Ferguson, in his essay on marsh poison, states, that it often happened that the soldiers belonging to the barracks at Monks-Hill, Antigua, who in perfect health mounted guard in the night, among the marshes at the foot of the hill, were seized while standing sentry, and when carried back to the barracks expired with the black vomit in thirty hours from the attack. And notwithstanding this, not a single case of yellow fever, nor of fever of any kind, occurred among those of the inhabitants of Monks-Hill, who were not obliged to sleep out of the garrison, or to take the duties in the marshes below.

732. This disease often is, and may at any time be produced by certain circumstances, without the presence of persons previously affected.

733. The memoir of Dr. Potter affords abundant

evidence that it often appears in situations in which there is no possibility of its having been received from a sick person.

“Mr. Ellicott, in his journal (of a voyage down the Ohio, in November, 1796,) is so explicit and intelligent on this subject, that no reasoning can shake his statement. His words are these: ‘I arrived at Gallipolis at eleven o’clock in the morning. This village is a few miles below the great Kenhaway, on the west side of the Ohio river, situated on a high bank; it is inhabited by a number of miserable French families, many of which, this season, fell victims to the yellow fever. The mortal cases were generally attended with the black vomit. This disease certainly originated in the town, and in all probability, from the filthiness of the inhabitants, added to an unusual quantity of animal and vegetable putrefaction in a number of small ponds and marshes within the village. The fever could not have been taken from the Atlantic states, as my boat was the first that descended the river after the fall of the waters in the spring; neither could it have been carried from New-Orleans, as there is no communication at that season of the year, from the latter to the former of these places; moreover, the distance is so great, that a boat would not have time to ascend the river after the disorder appeared that year in New-Orleans, before the winter would set in.’”

734. Dr. Potter received a more particular account of the same fever from major Prior of the army, who witnessed the rise and progress of the disease, which is given above (163); some particulars not there related are stated here. The sick generally died with

black vomit ; they were often yellow before death, and almost always afterwards. As some decisive measure became necessary to save the rest of the troops, a ditch was cut, what little water remained was conveyed off, and the whole surface covered with fresh earth. Not a man was seized with the worst form of the disease after the work was finished : and the sick were not a little benefited ; for they generally recovered, (though slowly,) because the fever became a common remittent, or gradually assumed the intermitting form. Frost put a period to the fever in every form.

735. The following “is equally explicit as to the indigenous origin of yellow fever. ‘At a village called New-Design, fifteen miles from the Mississippi, and twenty from St. Louis, containing about forty houses, and two hundred inhabitants, in the summer and autumn of 1797, the yellow fever destroyed fifty-seven of the inhabitants, or more than one fourth. No person had arrived at this village from any part of the country where the disease had prevailed, for more than twelve months preceding its appearance.’ Dr. Watkins resided in the village at the time, and having seen the disease in Philadelphia, testifies to the facts.”

736. Dr. Potter also mentions some cases of yellow fever, which occurred in a house near Baltimore in September, at a time when that city and the adjacent country were remarkably healthy. Struck with the circumstance, he examined the premises narrowly, and discovered that the cellar contained water which had remained there from the first week in June, the country having been then inundated with rain. The cellar being useless was closed, and the only vent for



the gas arising from it, was through the floor, which was open in several places. At his solicitation, the survivors were removed, and convalesced from that time. "But the tragedy did not end here. The owner of the house, anxious to retrieve its character, hired two men to empty the cellar." They ripped up the floor and drew off the whole of the water in one day, by means of a pump. In a few days after they both sickened, and died with the usual symptoms of yellow fever, hemorrhages, yellow skin, petechiæ, and one with the black vomit.

737. The same writer says, during the embargo in 1808, when no foreign sail whitened our waters, in August the yellow fever commenced its ravages at Fell's Point.

738. This disease has even been produced at sea, in circumstances in which there was not the slightest ground to doubt its generation on board the ship.

739. The United States ship-of-war General Greene sailed from Newport, in Rhode-Island, on the third of June, 1799. At sea the yellow fever broke out. The fever did not exist at Newport before the ship sailed. That town is too far north for the appearance of the yellow fever, except in very hot summers; or so soon in the year in the hottest. The ship touched nowhere, and had no communication with any vessel, until she arrived at Havanna after the appearance of the disease.

740. "The Busbridge, Indiaman, sailed from England for Madrass and Bengal on the 15th April, 1792; on the 26th of May she crossed the line in 26 degrees west longitude. The mercury ranged from 80 to 86

degrees. The weather was very sultry, with frequent rains. In this state of things the yellow fever broke out, although she touched at no port, nor had communication with any vessel.”<sup>1</sup>

741. A fever with hemorrhages, or oozing of blood through the cuticle, so as to stand in minute drops on the face, arms, and chest, occurred in Pennsylvania in 1805 (654); a fever with every symptom of yellow fever, including black vomit, originated near a number of ponds in the hot years 1797, 1798, and 1799, in Bald Eagle valley, Pennsylvania (239); fevers with similar symptoms occurred in 1797 and 1804 in New-York (233. 235); and many other instances have been mentioned in the preceding pages (655).

742. It is stated in the seventh volume of the Medical Repository, in an account of the yellow fever of 1803 in New-York, that “A large proportion of the epidemic consisted of instances in which an individual only was attacked in the midst of a family, the members of which assiduously attended the patient without contracting the disease. Many aged and very young persons, whose condition imposed confinement in their houses, without the occurrence of any preceding case in their families, were attacked with the disease in its most virulent form. Multitudes also took the disease, who had not previously approached any sick person, any suspected vessel, or any fomites alleged to be imbued with contagion. One person was attacked in the debtors’ prison, who for three months before had not been beyond its walls; and no person was previously, or subsequently, affected with the disease.”<sup>2</sup>

<sup>1</sup> Med. Recorder, No. 4, p. 526, &c.    <sup>2</sup> Med. Repos. Vol. 7, p. 183.

743. It is evident from a passage in Cleghorn's *Observations on the Diseases of Minorca*, that cases of yellow fever occurred in that island in hot summers. Speaking of the dangerous cases of the autumnal fever, he says, "But the utmost danger is to be apprehended, if a few drops of blood fall from the nose: If black matter, like the grounds of coffee, is discharged upwards or downwards: If the urine is of a dark hue, and a strong offensive smell: If the whole skin is tinged with a deep yellow, or any where discoloured with livid spots or suffusions:"<sup>1</sup> &c. These cases were as truly cases of yellow fever, as those mentioned as having occurred almost every year in company with the cases of common autumnal fever in Charleston, Boston, Philadelphia, and the West Indies (221. 413. 657. 658).

744. The yellow fever of 1793, in Grenada, was attributed by Dr. Chisholm to contagion derived from the crew of the ship *Hankey*, who had been almost exterminated by that disease at *Bulama*, an island on the coast of Africa. The circumstances under which that fever broke out, show unequivocally that it originated among the crew and passengers of that ship, and another, the *Calypso*. They sailed from England with a crowd of passengers to make a settlement at *Bulama*. There were no inhabitants on that island, but it belonged to the *Canabacs*, who resided on a neighbouring one. After some difficulty they purchased the island; but the rainy season coming on, and there being no kind of accommodation on shore, the passengers and crew determined to continue on

<sup>1</sup> Cleghorn's *Observations on the Diseases of Minorca*, p. 161.

board until the rainy season should cease ; and to protect themselves from the weather, they covered over the decks of the ships. In this crowded state, two hundred and seventy-five men, women, and children, besides the crews, were confined together, in the rainy season, in a tropical climate, on board two vessels, adapted by the covering over their decks, in an extraordinary manner, to give effect to the cause of fever. It is proper to mention that there was another very small vessel, but she was used as a despatch boat for various services, and had none of the passengers on board. In these circumstances, diarrhœa, dysentery, intermittent and remittent fever, and yellow fever, with black vomit, appeared, and carried off great numbers (672).

745. To this abundant evidence it is needless to add more. Suffice it to say, if any dependence is to be placed in the description of yellow fever by the medical gentlemen of the cities ; if any is to be placed in the decisions of the physicians of the country, founded on a comparison of cases occurring in their practice with these descriptions, and the occasional advantage of seeing for themselves, on their visits to the seaports ; fevers occasionally occur with the symptoms of yellow fever, including the black vomit, in situations in which it is impossible to believe the disease did not originate on the spot. For my own part, no inconvenience was experienced from a visit to Wilmington in 1798, to Alexandria, in the district of Columbia, in 1803, and again in 1821, during the prevalence of that disease in those places. In the last instance the visit was made for the sole purpose of inquiring into the origin,

&c. of the disease. In the course of three days every part of the town, particularly where the fever was most prevalent, was minutely examined. On approaching for the first time the bedside of a patient with yellow fever, the recollection of the earnestness with which my friends had withstood my intention, (representing it as a rash and needless risk of life,) as well as of the fate of the unfortunate Valli, at that time much talked of, unavoidably made an impression on my mind. But a confidence that the disease is not contagious, founded on the body of evidence before the public, supported me, and in a few moments I was perfectly at ease; for on beholding the patient, inquiring into the symptoms, and examining the discharges, it was evident that there was no greater danger from contagion than had been encountered before the visit, having left behind me in the country more strongly marked cases of the same kind. This patient was visited repeatedly every day until she died, and once after death. No inconvenience was experienced from the exposure during this visit.

746. We have then unquestionable proof, that the yellow fever often is, and may at any time be produced in certain circumstances without the presence of persons previously affected.

747. When the sick are carried out of these circumstances, or removed beyond the influence of the cause generated in them, no person who approaches them is affected.

748. This position is fully established by numberless instances, in which, when the sick are brought out of situations favourable to the spread of the disease,



into a pure air, the disease is not propagated; no one in the pure air being affected by the presence of the sick. Experience has long since shown, that the disease, when carried from a city into the pure air of a neighbouring village, does not spread; nay, that in the very city in which its fatal ravages are felt, there are parts in which, if a sick person be carried into them, the disease will not spread.

749. In Alexandria in 1821 the high and dry parts of the town were healthy, excepting one small spot (340); the sick were frequently carried into these parts and the disease did not extend, so that the people in them expressed a confidence that there was no danger from such occurrences. Dr. Potter, in the memoir abovementioned, challenges the whole population of Baltimore to produce a single instance of the disease spreading "in West Baltimore above Hanover-street," from one of the hundreds and thousands of those, who after breathing the pestiferous atmosphere in the lower parts of the town, and sickening there, were carried into the upper parts. In the Medical Repository it is stated that during the prevalence of the yellow fever in 1803 in New-York, many who had fled from the city were attacked with the disease and died, in all the surrounding country and towns, without communicating it in a single instance.<sup>1</sup>

750. The event of the case of the General Greene (739) is direct proof. "It became necessary in this disabled condition of the crew to return to the United States, and on the 27th of July the frigate arrived at

<sup>1</sup> Medical Repository, Vol. 7, p. 183. See also Medical Recorder, No. 10, p. 213. No. 13, p. 160. 162. No. 33, p. 5. 9.

Newport. She was subjected to an entire unloading ; the sick with all their clothes were sent to the hospital. Mark the end of this disaster ; neither the citizens (who could not be entirely excluded from intercourse with the crew,) nor the attendants of the hospital contracted the disease."

751. The case of the *Regalia* transport is one of the strongest that ever occurred (171, &c.). While, with a crew perpetually sick, and dying in such numbers as to require continual recruiting, she was traversing the West India seas in every direction, and leaving sick persons at every port, no fever was communicated to any person by the sick she sent ashore in any one place. This made such an impression on the mind of Dr. Ferguson that he expresses himself thus. "I am aware how much I have been favoured by circumstances, and what a different interpretation the facts I have collected would have borne, had the present epidemic that now afflicts the islands broken out in the ordinary course of seasons a year earlier, at the time the *Regalia* was here ; my task would then have been a much more difficult one, for these (facts) instead of assisting me to elicit the truth in the manner I have done, would in that case have been turned to the confirmation of error, and the perpetuation of the delusions, in regard to imported contagions."<sup>1</sup>

752. We find therefore that the yellow fever does not possess the characteristics of a contagious disease, viz. that of affecting a person but once ; and that of spreading until it become universal, even in the circumstances favourable to its extension, unless stopped by insulating the sick (718. 719. 720).

<sup>1</sup> Bancroft's Sequel, p. 239.

Moreover, great numbers placed near the sick, attending on them, escape entirely (727, &c.); it is produced in certain circumstances, whenever they occur, without the presence of any person previously affected with the disease (732, &c.); and when the sick are carried out of these circumstances, or removed beyond the influence of the cause generated in them, no person who approaches them is affected (747, &c.). We must therefore conclude that the yellow fever is not propagated by a volatile contagion.

753. In opposition to a conclusion resting on such strong grounds, the doctrine of the contagious nature of the yellow fever rests solely on the appearance of the disease after a sick person has been introduced into a town, and on the rapid spreading of the disease.

754. As to the first, it has been shown that the disease has originated in certain circumstances without the introduction of the sick (732 to 745). Therefore there is a cause independent of communication with them, or of contagion derived from them; and that this cause is a gas, produced in such circumstances, is evident from the effect of exposure to a wind blowing over the places in which those circumstances exist (162. 163. 223. 224. 229. 317. 383. 390. 402. 431. 432), as well as from the effect of cutting off the source of it by draining, filling up, overflowing, &c. (224. 226. 228. 441).

755. It is also well known that this disease very often does not follow the introduction of the sick (747 to 751). Therefore such introduction is not alone sufficient to produce it. It is further known, that it never spreads after the introduction of the sick into

a town, unless the town be in a foul state, and the temperature be very high. Now, these are the very circumstances in which the disease has been shown to have originated (754). Consequently the gas produced in these circumstances is the cause ; and the introduction of the sick is not.

756. The rapid spreading of the disease is the other ground alleged in support of its contagious nature.

There is nothing in this circumstance to indicate the *nature* of the cause ; all that we can infer from it is that the cause is extensive in its operation. The gas which arises in the circumstances in which this disease *always* appears, is capable of being applied to any number of persons at one moment ; nay, if they be in the direction of the wind blowing over the spot in which those circumstances exist, and there be no obstruction, it cannot be avoided (163). It is therefore better adapted to the rapid production of the disease, than contagion ; any contagion ascertained to exist, as the variolous, being incapable, as is well known, of affecting a person at the distance of twenty feet. The former indeed is capable of the rapid production of the disease, and contagion is not (705).

757. There is evidently, therefore, no foundation for the doctrine in either of these circumstances ; nothing to produce a doubt of the correctness of the conclusion that the disease is not contagious.

### *Of the contagion attributed to the plague.*

758. It is perhaps generally believed by physicians, that the plague is propagated by a peculiar contagion. It is nevertheless entirely destitute of the characteristics of a contagious disease.

759. 'The plague affects the same individual repeatedly.

Dr. Russel, in his account of that disease in Aleppo, in 1760, 1761, and 1762, says, "In the plague, contrary to what happens in the small-pox, persons are liable to be affected more than once; not only at long intervals, and in different climates, but in the same town in the course of the same pestilential season. This fact, which has been doubted formerly by some physicians, and by others expressly contradicted, has been long established on the best authorities."<sup>1</sup>

760. Out of 4,400 cases which Dr. Russel treated in the years 1760, '61, and '62, there were twenty-eight instances of persons who had it twice in that time. It was impossible, he says, to obtain satisfactory information respecting the number of those who had had it in former years: the last plague was eighteen years before; some were too young to remember; the accounts of others, *who said they had*, were for the most part too vague to be depended on. He saw none who had it more than twice, but was credibly informed of persons who had it three or four times.

761. That the proportion of those who had this disease a second time, to those who withstood the influence of the cause after the first attack, was really greater than what is above stated, will appear if we consider, first, that their number should be compared, not with the whole number of cases, but with the number of persons who recovered. Some judgment may be formed of this from some expressions of Dr. Russel. He says before the middle of June, in 1761, a

<sup>1</sup> Russel's account of the Plague in Aleppo, p. 180.



small proportion recovered. An instance is given of three only recovering out of sixty-eight; another of about the same number out of sixty or seventy;<sup>1</sup> and another of only one out of forty.<sup>2</sup> This was the last of March. From the middle of June to the first of October it was less fatal; and from the middle of October to the end of the year hardly one third recovered.<sup>3</sup> From the middle of August, 1762, a very small proportion of those affected recovered.

762. If we consider further the restriction of the term re-infection to those cases only in which the patient had perfectly recovered, and when the symptoms of the second disease seemed as manifestly to proceed from recent infection as those which had attended the first, we shall have reason to believe that the proportion was still greater.

763. The great bulk of the cases occurred in the six weeks after the first of June. There were few recoveries before the first of that month. The convalescence was slow, extending generally to four weeks; the danger of taking the disease ceased comparatively in July, the disease rapidly declining after the middle of that month; very few therefore had time perfectly to recover, so that "the symptoms of the second disease should as manifestly proceed from recent infection as those which had attended the first." In case CIX it is laid down, that if a person has a running bubo, a second attack in the time must not be considered as a re-infection, but as a relapse. A great many of those who recovered had, for some time after, running buboes; and all of those who were again at-

<sup>1</sup> Russel's Treatise, p. 26. 27. <sup>2</sup> Ibid. append. p. viii. <sup>3</sup> Ibid. p. 41.

tacked were excluded. Dr. Russel admits the difficulty of deciding between a relapse and a re-infection, and only puts down in the latter class those *manifestly* belonging to it. What is a relapse during convalescence but a renewed attack? Names do not alter facts. The return of the disease, with all its symptoms, is proof of renewed action of the cause; and is sometimes indeed more severe than the first attack.

764. If therefore we consider the small proportion of the recoveries, the exclusion of all who relapsed, and of all who had had it in former plague seasons, we shall find the proportion of those who have second or third attacks in plague, not less than in other fevers. Thus, you would seldom find a man who had had in one season a second distinct attack of bilious fever, after having perfectly recovered from the first. In the fall of 1823, for instance, which was more sickly than any other for nineteen years before, I have no recollection of any such second attack; and never knew or heard of a third or fourth. But if we extend our views to past years, we shall find many who have had it before. Dr. Russel had, therefore, full ground for saying that the plague is a disease by which persons are liable to be affected repeatedly. Therefore it is not propagated by a volatile contagion (718).

765. If this disease were propagated by a volatile contagion, unless stopped by insulating the sick, by means of attendants not liable to be attacked in consequence of having once had the disease, it would become universal (719); and, if propagated by a contagion acting only in certain circumstances, unless stopped as above, it would continue to spread until all in

those circumstances were affected (720). But no attempt is made to insulate the sick in this manner, and the disease does not spread until all, in the circumstances favourable to it, are affected.<sup>1</sup> Therefore it is not propagated by a volatile contagion.

766. Abundance of facts support this conclusion, which shall be arranged under three heads. 1. In persons placed near the sick the disease is very often not produced. 2. The disease is produced by certain circumstances without the presence of the sick. 3. It does not spread in presence of the sick without the concurrence of these circumstances.

767. In persons placed near the sick, the disease is very often not produced. The following facts are from Dr. Russel's treatise on the plague.

768. In the family of the Neapolitan consul, the consul himself and six or eight others died. The widow of a Neapolitan gave constant attendance on all these without any bad consequence.<sup>2</sup>

769. A French surgeon took the disease and died. He was attended by his partner, by a priest, and by two servants, of whom the priest only took it.<sup>2</sup>

770. A young Greek, whose constant occupation was to nurse the sick, and assist the buriers of the dead; and "a Grecian woman, exceedingly corpulent; who having affectionately nursed her husband, during his illness, and two of her daughters, who both died of the plague, continued afterwards to expose herself with uncommon courage, in the assistance of all the sick in the neighbourhood;" both escaped.<sup>2</sup>

<sup>1</sup> In Aleppo there were in the year 1761 about 12,000 sick of the plague. The population was about 230,000, near 20 times as many.

<sup>2</sup> Russel's Treatise, p. 7.

771. The superior of the Terra Santa convent was taken ill and died; and the other fathers, as the convent had shut up at the same time with the European merchants in the beginning of February, *having no suspicion that the disorder could be the plague*, communicated freely with him at the beginning of his sickness. When the certain marks of the plague were discovered, the fathers were much frightened, but all of them escaped.<sup>1</sup>

772. The porter at a public house, his son, and brother, died of the plague. The former was searched repeatedly by the attendants and by Dr. Russel, for tumors, and neither of them, nor of four Armenians who by turns attended the sick, was affected.<sup>2</sup>

773. A Jew banker died on the third day of his illness. None of several female attendants constantly employed about him took the disease.<sup>3</sup>

774. "It is remarkable, that before the middle of June (1760) it was rare to find more than one person sick in one family, even in the houses of the meaner class; and the attendants employed about the sick so often escaped, that the people were too often led to believe it was not the true plague."<sup>3</sup> Nevertheless, at this very time the disease was so fatal that almost all that took it died (761).

775. In the beginning of August a rabbi who kept a school for boys was taken ill. Dr. Russel found him surrounded by above a dozen of his scholars, besides several women and children of the family, of all whom none took the disease except his wife, who fell ill within eight days after him and recovered. The man himself died on the sixth of August.<sup>4</sup>

<sup>1</sup> Russel's Treatise, p. 7.   <sup>2</sup> Ibid. p. 17.   <sup>3</sup> Ibid. p. 19.   <sup>4</sup> Ibid. p. 24.

776. "In the fourth week of July, 1762," (when the plague was rapidly declining,) "died Padre Carlo, of the Terra Santa convent. He had voluntarily devoted himself to an attendance on the affected ever since the spring of 1760, and had indeed exposed himself with uncommon resolution in the exercise of the most humane, as well as the most dangerous offices about the sick. I have often had occasion to meet with him in the course of my visits, and have sometimes found him, when the ordinary attendants were not in the way, employed in supporting the sick in his arms while they sat up in bed to take their medicine."<sup>1</sup>

777. A Jewish girl died of the plague on the tenth of May. The family consisted of twelve or fourteen persons, including four or five other children, most of whom had frequented the chamber and communicated with the sick girl during the three first days. She had also been constantly nursed by one woman and two men, but all escaped.<sup>2</sup>

778. In the great harems the disease seldom spread much; of perhaps above forty females not more than four or five being infected.<sup>3</sup>

779. Russel says that when *shut up*, as is practised by Europeans generally, he continued to issue medicine to the sick who went in crowds to his dwelling, and when he wanted to examine the eruptions, he brought the patients within four or five feet by means of a stairway that passed by one of the windows of the house in which he was confined. If we consider the great dread of the disease entertained by Europeans, and the obligation and necessity the doctor was

<sup>1</sup> Russel's Treatise, p. 55.    <sup>2</sup> Ibid. appendix, p. xx.    <sup>3</sup> Ibid. p. 62.



under not to risk the health of those confined with him, and the odium he would have incurred by doing any thing likely to introduce the plague, of which his expressions show he was very sensible, it is evident that, although he considered the disease contagious, his experience had taught him he was perfectly safe at the distance of only four feet from the sick.

780. Assalini, in his account of the plague in Egypt, says, "I have seen a great number of persons who have been attacked by the epidemic, after having had communication with others who were already sick; and I would have adopted the conclusion, that it was to contagion they ought to attribute their disease, if I had not also seen a much greater number who continued to enjoy good health, in spite of the most decided communication."<sup>1</sup>

781. He says that the quarantine near Cairo was continually eluded by the people and the soldiers without producing any bad effect. He mentions three soldiers who went from a neighbouring fort to Cairo, and died of the plague two days afterwards. They had intercourse with more than sixty persons, but not a symptom of the plague followed in any of them.<sup>2</sup>

782. A native practitioner was employed by the French at Jaffa, and opened the buboes indiscriminately. "For several years he had attended such inhabitants of Jaffa as were attacked by the plague, and he used no precaution whatever to preserve himself from this complaint, nor to avoid contact."<sup>3</sup>

783. In Egypt the plague uniformly begins to decline in June, and ceases generally about the last of

<sup>1</sup> Assalini, p. 17.    <sup>2</sup> Ibid. p. 18. 19

<sup>3</sup> Ibid. p. 20.

that month. The popular belief is, that it ceases altogether on St. John's day, and immediately afterwards the clothes of the many thousands that have died during the plague, are handled, bought, put on, and worn without any apprehension of danger; and though these consist of furs, cotton, silk, and woollen cloths, which are stuffs supposed to be most retentive of the infection, no accident happens to those who wear them.<sup>1</sup> It is however known, that although the plague declines fast in June, and generally ceases about the last of the month, yet it sometimes continues until the middle of July.<sup>2</sup> It is evident, therefore, that even before the plague ceases, there is the most perfect safety in freely handling and wearing the clothes of the dead.

784. Dr. Russel also gives an extract from a book published in 1665 by Kemp, in which it is stated, that "in the ending of the last great sickness (1625), the people went promiscuously one among another, and the houses were quickly filled with inhabitants, and fresh comers out of the country, and yet no infection followed." Also during the siege of Bristol, about twenty years before (1665), hundreds died every week of the plague; but as soon as the city was taken, "the soldiers made no great difference of quartering in any houses, or coming into any company, and the inhabitants returned to their forsaken dwellings at one gate, whilst the pestilence went out at the other, and hath not hitherto returned again."<sup>3</sup>

785. Hodges, in his account of the plague in Lon-

<sup>1</sup> Russel's Treatise, p. 266, note. Extract from Bruce's travels.

<sup>2</sup> Ibid. p. 266, and note. <sup>3</sup> Ibid. p. 272, note.

don in 1665, says, "The houses which before were full of the dead, were now again inhabited by the living; and the shops which had been most part of the year shut up, were again opened, and the people again cheerfully went about their wonted affairs of trade and employ, and even, what is almost beyond belief, those citizens who were before afraid even of their friends and relations, would, without fear, venture into the houses and rooms where infected persons had a little before breathed their last: nay, such comforts did inspire the languishing people, and such confidence, that many went into the beds where persons had died, even before they were cold or cleansed from the stench of the disease."<sup>1</sup>

This occurred "early in November," and the disease, so far from increasing, as it must necessarily have done if it had been contagious, rapidly declined, and soon ceased. In the week ending on the third of November, 1414 persons died; in the week following, 1050 died; in the second week after, 652 died; in the third week, 333 died; and 210 in the week ending on the first day of December.<sup>2</sup>

786. The disease is produced by certain circumstances without the presence of the sick (766). The plague frequently appears on board of ships in the course of their voyage from the ports of the Levant to those of France and Italy.

787. Captain Chataud's vessel which was believed to have introduced the plague into Marseilles, in 1720, left the coast of Syria on the 31st of January, before the plague broke out there, and had a clean patent.

<sup>1</sup> Russel's Treatise, p. 270.

<sup>2</sup> Ibid. p. 276.

On the voyage the disease broke out, and he lost several of his crew. The fact is unquestionable ; but Dr. Russel endeavours to show they received the contagion before they left Syria. He observes that the plague broke out there soon after her departure ; that the disease generally lies lurking some time in the place before it occasions alarm, but was rife in the maritime towns of Palestine and Syria from the month of March ; and that three vessels with foul patents arrived at Marseilles a few days after the arrival of captain Chataud.<sup>1</sup> It must be admitted that there was small probability of the crew being affected by contagion (admitting it to exist) when they left the coast the 31st of January, a time when there is never much of the disease in that country ; when it was not known to exist at the time ; when it was not “rife” until about two months after ; and when we consider the very large proportion of those who escape even when they nurse the sick (768, &c.). There is another source insinuated. He put into Tripoli to repair some damages sustained by bad weather ; and after repairing them took in some merchandise and some passengers. It is not said the disease prevailed at Tripoli, and the clear presumption consequently is that it did not, or it would have been mentioned in an argument to support the contagious nature of the plague. The passengers unquestionably were not sick at the time, or they would not have been received ; but soon after one of them fell sick and died. “Two of the sailors employed to throw the corps overboard desisted at the desire of the pilot, and the rest of the ceremony was performed

<sup>1</sup> Russel's Treatise, p. 218.

by the rest of the Mahommedan passengers." "Within a few days the two sailors who had handled the corps were taken sick and died. At Cyprus the ship put her remaining passengers on shore, and made a very short stay. Soon after her departure from that island, a third sailor and the surgeon died of an illness of a few days' duration." "Some time after this three more sailors fell sick, and there being no surgeon on board, the vessel put into Leghorn, where the three sick men died, and the physician and surgeon of the Lazaretto declared the disease to be a malignant pestilential fever."<sup>1</sup> It is remarkable here that the death of the sailors was attributed to handling the dead body, although the surviving passengers who were engaged likewise in committing it to the deep, and who moreover attended to the sick man before death, escaped. Now it is admitted that the risk from handling the bodies of those who have *died* of the plague is inconsiderable; the danger is in being about the sick. The other passengers, therefore, should have taken it, and the sailors have escaped; and as the former did not, the latter, who were less exposed, could not. It could not have proceeded from the goods, because they were put on board long before the plague broke out, and because entire bales are not said to be noxious, the danger arising from unpacking them. This source is therefore not hinted at. The disease must therefore have originated among them, as, we know, pestilential fevers have very often done; especially in bad weather at sea, as was the case here; and as occurred in the case of the General Greene on her voyage from

<sup>1</sup> Russel's Treatise, p. 222. 223.



Newport to Havanna. In this case, the people of Havanna had a plausible ground for alleging that this ship introduced the fever from Newport; and if it had happened, that a case of the fever had also appeared at Newport a few days after her departure, the advocates of the contagious nature of yellow fever would have rested great weight on it (739).

788. It appears from Assalini's account of the plague in Egypt, that, at the period at which it broke out, it could not be imputed to contagion introduced, because the English fleet so strictly blockaded the coast that no vessel had been able to enter.

In consequence of this, the advocates of contagion were reduced to the necessity of attributing it to goods which since the preceding year had been left infected in the magazines of Alexandria and Aleppo.<sup>1</sup> If we compare this supposition with what has been already stated respecting the sale of the clothes of the dead, even before the disease had fairly ceased, we shall discover at once its absurdity, and be compelled to admit that the plague was generated on the spot.

789. That certain circumstances are necessary to the existence of the plague, is evident from its uniformly increasing and decreasing with the increase and decrease of the temperature of the season in London;<sup>2</sup> and from its uniformly declining and ceasing in the month of June in Egypt.<sup>3</sup> Russel, though he believed the disease to be contagious, repeatedly asserts this. He says, "The state of the air instrumental in propagating the plague, varies in its degree of power, as also in its duration."<sup>4</sup> Again, "Should ever that

<sup>1</sup> Assalini, p. 15.      <sup>2</sup> Russel's Treatise, p. 276.

<sup>3</sup> Ibid. p. 266.

<sup>4</sup> Ibid. p. 273.

state of air, *without the concurrence of which the contagion of the pestilence never spreads, or ceases to act, be discovered,*"<sup>1</sup> &c. He says, that notwithstanding the vigorous measures taken by the police for extinguishing the plague at Marseilles, it continued to linger for several months after; and there can be little doubt, that if the pestilential constitution of the air had continued, the disease would have continued to spread. "We have seen also at Aleppo, in 1762, that the plague ceased completely without any exertion whatever on the part of the police; and experience in other places of Turkey, as well as at London, Nimeguen, and Dantzick, furnish similar examples. Hence, it may be inferred that the termination of the plague of Marseilles was owing principally to a change in the constitution of the air,"<sup>2</sup> &c.

790. Moreover, it is well known that the hot and moist country of Egypt is very subject to this disease. Holland also, which was formerly much more subject to inundations than it now is, was then remarkably subject to the plague. "Forestus remarks, that, from the putrefaction of the water only, the city of Delft, where he practised, was scarce ten years together free from the plague or some pestilential distemper."<sup>3</sup>

791. These are enough to show that a peculiar state or constitution of the atmosphere, arising from circumstances of situation and weather, is necessary to the prevalence of the plague; and when we consider that it increases and decreases at the same period of the year (783. 789), in connexion with the impossi-

<sup>1</sup> Russel's Treatise, p. 280.      <sup>2</sup> Ibid. p. 282. 283.

<sup>3</sup> Pringle on the Diseases of the Army, p. 323.

lity of its having been introduced on some of these occasions (788), it is evident that the disease is generated in these circumstances. What these are, will be more fully shown hereafter.

792. If the sick be carried out of the circumstances in which the plague arises, it does not spread (766.)

793. In 1759 the crew of a ship wrecked on the island of Cyprus, affected with the plague, straggled across the island through a number of villages and towns. Some of the sailors died in the villages. The rest, after a short stay at Limsol, proceeded to Larnica, where they remained only a few days. None died in Larnica, but it was known that several actually had the plague. The disease spread with great rapidity at Limsol; but although Larnica had received part of the infected crew from Limsol, maintained a constant intercourse with the infected quarters of the island, and some of the persons from other parts of the island had died with the plague in the houses of Larnica; though two vessels afterwards arrived, with the plague, and the infected passengers and sailors lodged in the houses and communicated freely with the natives, and one of them died at the marine, none of the inhabitants of this town were known to have contracted the plague.<sup>1</sup>

794. During the plague in 1762, in Aleppo, Tripoli was apprehensive of the disease, and the alarm was heightened by the frequent arrival of fugitive families from Aleppo, who, according to the custom of the East, had brought their bedding along with them. Although in some of those families there were persons actually

<sup>1</sup> Russel's Treatise, p. 4.

in the plague, no instance was known where the contagion was communicated to the natives of Tripoli.”<sup>1</sup>

795. “In the mean time so far is certain, that, although infected persons came from the mountains to the three towns just mentioned, and some of them died in the families where they lodged, yet the distemper by such means was not propagated,”<sup>2</sup> &c.

796. “*Experience in Turkey*, where generally no precautions are taken in the times of pestilence, *clearly evinces, that in a certain state of the air*, a communication with infected places may subsist without any material consequence. The return of the plague at Aleppo happens at irregular periods; the intervals are of considerable but unequal length; and in those (intervals) the commerce with Egypt, Constantinople, and Smyrna remains uninterrupted. In the intervals between 1744 and 1760, and from 1762 to 1780, the plague raged several times in the places now mentioned, without affecting Aleppo; and even in two or three years subsequent to 1762, though it was at Marash, as well as other places not far distant, with which Aleppo has continual intercourse, no instances were discovered of communicated infection: if such happened, they must have escaped my utmost vigilance; and the daily exercise of my profession led me to be very much among the natives of all ranks. At the same time, I have reason to suspect that infected families from some of these places took refuge in Aleppo; and I know with certainty, that not only some merchants of that city, who happened to be at Marash when the plague broke out there, returned to their fa-

<sup>1</sup> Russel's Treatise, p. 12.

<sup>2</sup> Ibid. p. 26.

milies in the summer of 1763, but that caravans of various merchandise arrived in the course of the same summer.”<sup>1</sup>

“I consider it therefore (says Dr. Russel,) as an established fact in the Levant, that commerce and intercourse with infected towns is sometimes attended with no bad consequence.”<sup>2</sup>

797. We find therefore that the plague does not possess the characteristics of a contagious disease, viz. that of affecting a person but once; and that of spreading until it become universal, even in the circumstances favourable to its extension, unless stopped by insulating the sick (759 to 765).

We have moreover abundant evidence, that, in persons placed near the sick, even in circumstances favourable to the spreading of the disease, it is very often not produced (768 to 785); that it is often produced without communication with the sick (771. 787. 788); and that, when the sick are carried out of the circumstances favourable to the prevalence of the disease, it does not spread (793 to 796). But the ground of our belief, in the propagation of a disease by volatile contagion, being, that it is produced on exposure to the sick, without any other possible means of accounting for the phenomena, and that it is never produced without such exposure (707. 708); we are in this case entirely destitute of it, and must conclude that the plague is not propagated by a volatile contagion.

798. There is nothing to oppose to the conviction arising out of this argument, but the two circumstan-

<sup>1</sup> Russel's Treatise, p. 280.      <sup>2</sup> Ibid. p. 281.



ces of the disease sometimes spreading after persons affected with it have been introduced into a town, and of the rapidity with which it spreads.

799. It is however certain that this disease very often does not prevail in towns, into which persons affected with it have been carried (793 to 796); that a peculiar state of the air is necessary to its prevalence (789. 790); that it originates in certain circumstances without the introduction of persons affected (787 to 791); and that, even when the disease is so violent and mortal, that almost every one affected dies, it often does not affect more than one in a house (774): whence it is most evident, that the cause is independent of communication with the sick.

800. The rapidity with which the disease spreads, indicates nothing of the *nature* of the cause; it only shows that its application is extensive; while the extent of its influence, and its dependence on a peculiar state of the air (789. 790), connected with the affection of a single person only in a house, in many instances (774), and that without communication with the sick (771), shows that it is spread by a cause which has general access, but which does not emanate from the sick; and therefore is not a contagion (700).

*Of the contagion attributed to typhus fever.*

801. The fever called typhus has received various other names. Dr. Currie speaks of “typhus *or* jail fever.”<sup>1</sup> He says, “When the term fever is used in the present work without any adjunctive, it is the low contagious fever that is meant. This is the typhus of

<sup>1</sup> Currie’s Medical Reports, p. 23.

Dr. Cullen; the contagious fever of Dr. Lind; febris irirritativa of Dr. Darwin. In popular language it is generally called the nervous fever, and when particular symptoms appear, the putrid fever." "This is the common fever of England,"<sup>1</sup> &c. "Doubtless, the typhus, or low contagious fever, is the prevailing fever of this island and of Europe. It is the epidemic of all our great towns, of our jails, hospitals, manufactories,"<sup>2</sup> &c.

Dr. Pringle says he has observed the same fever which arises in crowded *hospitals*, arise in crowded *barracks*, in transport *ships* filled beyond a due number, and detained long by contrary winds, or when the men have been long kept at sea under close hatches in stormy weather, and says it is the same as what is called in England the jail distemper, and is incident to every place ill-aired and kept dirty.<sup>3</sup>

Thus we find that the common fever of England, epidemic in the great towns, the typhus, the jail fever, the hospital fever, the ship fever, the putrid fever, and the nervous fever are the same.

802. This fever also has been very generally considered as contagious, but it has not the characteristics of a contagious disease.

803. A person is liable to repeated attacks of this fever; therefore it is not propagated by a volatile contagion (718).

804. If typhus fever were propagated by a volatile contagion, unless stopped by insulating the sick, by means of attendants not liable to be attacked in con-

<sup>1</sup> Currie's Medical Reports, p. 27.      <sup>2</sup> Ibid. p. 48.

<sup>3</sup> Pringle on the Diseases of the Army, p. 287.

sequence of having once had the disease, it would become universal (719); and if propagated by a contagion acting only in certain circumstances, unless stopped as above, it would continue to spread until all in those circumstances were affected (720). But it is not attempted to insulate the sick in this manner, there being no persons thus exempt from the disease, and the disease does not spread until all, even in the circumstances favourable to it, are affected. Therefore it is not propagated by a volatile contagion.

805. This conclusion is not less strongly supported by facts than by argument. 1. In persons placed near the sick the disease is very often not produced. 2. It is often produced by certain circumstances, without the presence of sick persons. 3. It never spreads in presence of the sick, without the concurrence of these circumstances, which are sufficient at any time to produce it.

806. In persons placed near the sick the disease is very often not produced. There is abundance of evidence of this in the writings of the advocates of the doctrine of the contagious nature of typhus fever. The following is from Dr. Currie's letter to Dr. Clarke,<sup>1</sup> and from Trotter's *Medicina Nautica*. It is to be borne in mind that they both firmly believed this fever to be propagated by contagion.

807. Dr. Currie says, the Liverpool work-house sometimes contained fourteen hundred persons. All, sick or well, pass through a small door at which stands a porter. The sick, whether labouring under fever or not, are received at this door, carried across a passage

<sup>1</sup> Currie's Medical Reports, appendix.

to receiving rooms, one for each sex, are stripped, washed, and have their clothes changed ; and remain there until the apothecary on his daily visit sends those under fever to the fever wards.

On the first floor, is the great dining room ; on the second, the lock hospital for females ; on the third, the fever wards ; and on the fourth, the children's nursery.

808. For the ten years in which the wards have remained in this situation, there has been no typhus fever in the lock hospital. The children are continually passing up and down the stairs, and playing in the staircase ; and at particular times of the day, as immediately before dinner, they are crowded towards the bottom in a remarkable manner. While Dr. Currie was one day examining the staircase, a patient under fever was brought across the court a little previous to the dining hour. He counted exactly eighty-three children on the stairs, within three or four feet of every one of whom the patient passed, and much nearer to some. On mentioning the circumstance to the nurses, they seemed to think it nothing uncommon, but as *what might happen every day*. Though no clear instance of injury from such occurrences *could be brought*, he urged in the parish committee the propriety of having a distinct passage to the fever wards. Various consultations were held on this subject, but the structure of the building rendering such an alteration impossible without entirely defacing the front, the want of any actual proof, or *even appearance of injury* from using the common staircase, cooled their zeal.

809. On one occasion, however, a fever broke out in the nursery, and extended to sixty-seven children, all of whom recovered. This was attributed to the introduction of the children of a family, sent in a state of fever to the work-house, into the nursery with some degree of the disease upon them, and without removing the infected clothes worn before they came into the house. Yet, "two of the nurses have each of them a child actually living with them in the wards, and going out to school in the day. These children appear neat, clean, and healthy, though they sleep in the very centre of the patients every night. Their mothers were convinced that they were not liable to any injury, for they never came into contact with the patients; and they seemed to think they should be themselves perfectly safe, if it were not that they are employed in offices that oblige them to be *often*, and sometimes *for a considerable time together*, in contact with the sick, and exposed to the undiluted exhalations from their skin and their lungs." Notwithstanding this great exposure, all that is alleged is, that "in the course of ten years, several have caught the contagion, but assistance being immediately had, one only has died, so far as I can learn, a woman upwards of sixty, and otherwise very infirm." Accordingly, "experience has taught them to estimate even this hazard very lightly; and it is in fact as easy to get a nurse for the fever wards, as a servant for any other part of the house."

810. "Notwithstanding the healthfulness, and especially the exemption from fever, of all the places in the immediate vicinity of the fever wards, in the year 1801



the master and mistress of the house, and a young woman, daughter of the assistant mistress, were, *at different times*, affected with typhus, and all of them died. This circumstance occasioned great agitation. The master of the house had never been in the fever wards, the mistress very seldom, and they lived in a part of the building very remote."

The patients are generally examined by the master or mistress on the inside of the door. To this exposure before the patients were washed, the doctor attributes the death of these two persons. But the porter who opened and shut the door several years, escaped; and they themselves escaped eight years.

The young woman's fever is attributed to her having "been incautiously turning over the linen from the fever wards before it had been steeped in water." But the persons who brought it together and washed it, are not mentioned as having been affected; and even of those who, on the entrance of the patients, were "employed in washing and cleansing the clothes of the patients in the receiving houses," it is only said that they were sometimes affected; but being on their guard and applying in time, fatal consequences never ensued.

811. The amount of the whole is, that in a house sometimes containing fourteen hundred persons, and, at different times in the course of the year, receiving twelve thousand patients, and in one year eighteen thousand; the master or mistress generally examines the patients, and one master and one mistress have died in ten years; the porter has stood for several years at the door, opening and shutting for all, sick

or well, that come and go, and escaped entirely ; the patients are every one stripped and washed, and the persons who do this have sometimes been sick, but none ever died ; the patients of all sorts are stripped and washed and remain together in the receiving rooms, one for each sex, until the apothecary pays his daily visit, and sends the fever patients to the fever ward, but in ten years the fever has never appeared in the lock hospital ; crowds of children are continually playing on the staircase which the fever patients ascend to their ward, and in ten years there has been but one sickly time among them, and none died ; nurses, with their children, sleep every night in the midst of the fever patients, and the former are often for a considerable time in contact with the patients, receiving the undiluted exhalations from their skin and lungs ; yet the children are healthy, and of the nurses only one has died in ten years, and she was upwards of sixty, and otherwise infirm.

812. Trotter abounds with evidence to the same amount ; and his evidence is the stronger, because he also was a firm believer in the contagious nature of the disease, and invariably speaks of the manner in which it was supposed to have been introduced ; insomuch, that, in one instance, the surgeon of a ship not having given his opinion on this point, he remarks the omission. The following quotations are from his *Medicina Nautica*.

813. “ A fever, of the typhus kind, appeared among the gentlemen of the *Invincible*, in Torbay, which extended to a number of cases. Yet, it is singular, that it did not affect any of the seamen, although some of

them attended their officers, who slept in the gun-room, and when communication with the ship's company was not prevented."<sup>1</sup>

814. "The Niger has been ten weeks at sea: at leaving port four relapses in fever happened among men discharged from Haslar. Mr. Burd does not assign any cause for these returns; *no infection spread from them.*"<sup>2</sup>

815. Speaking of the Charon hospital-ship, Trotter says, "We had in that hospital many malignant cases of typhus, and some deaths, yet no infection was ever spread there."<sup>3</sup>

816. "We know of nothing that can propagate this fever, but exhalations from the body. But a patient in typhus was sent from the Venerable to the hospital-ship, with a fœtor about him, that exceeded any thing of the kind which ever came within my knowledge. After being washed and shifted, it still continued; and was perceived at a considerable distance. He died in a few days; yet nobody was infected from him, either in his own ship, or our hospital."<sup>4</sup>

817. In 1790 a number of troops embarked on board the Gorgon to go to New South Wales. While lying in the harbour of Portsmouth, typhus fever prevailed among the soldiers, and several died. "The troops lived in the lower deck; and when the ports were shut at night, the exhalations from below naturally ascended through the gratings among the sailors;" but the seamen of the ship were totally exempt from it; "not one of them having had the slightest sign of infection."<sup>5</sup>

<sup>1</sup> *Medicina Nautica*, Vol. 1, p. 109.

<sup>2</sup> *Ibid.* p. 164.

<sup>3</sup> *Ibid.* p. 179.

<sup>4</sup> *Ibid.* p. 195.

<sup>5</sup> *Ibid.* p. 210.

818. "The London also, at this time, had ten cases of typhus, derived from this source, and entirely *confined* to raw landsmen."<sup>1</sup> The same occurred on board *La Pique*,<sup>1</sup> and many other cases mentioned.<sup>2</sup> Here is abundant proof that in persons placed near patients in typhus fever, the disease is very often not produced.

819. The typhus fever is often produced by certain circumstances without the introduction of sick persons, or any other source of contagion (805).

820. Pringle says he has often seen the hospital or jail fever arise in crowded hospitals and barracks; and in transport ships filled beyond a due number, and detained by contrary winds; or when by stormy weather the men have been kept long at sea under close hatches.<sup>3</sup> He gives instances in the campaigns of 1743 and 1748 in Holland.<sup>4</sup>

821. "Dr. Lind informs us, that, in a frigate which sailed from North America, with a healthy crew, a malignant fever broke out before her arrival in England, during very bad weather, which affected a considerable number of the men, and of which the surgeon's mate, boatswain, and some others, died. "Thus," he remarks, "a seasoned sound crew became infected, as it would appear, from the closeness or damp below, occasioned by the hatchway being kept shut."<sup>5</sup>

822. Dr. Currie, a decided advocate for the contagious nature of this disease, speaking of a typhus fe-

<sup>1</sup> *Medicina Nautica*, Vol 2, p. 60.      <sup>2</sup> *Ibid.* Vol. 3, p. 98.

<sup>3</sup> Pringle on the Dis. of the Army, p. 287.      <sup>4</sup> *Ibid.* p. 22. 25. 68.

<sup>5</sup> Rees's Cyclopaedia, article Contagion.

ver which originated at Canterbury, says, "On considering every thing, this cause may reasonably be traced to the crowded and uncomfortable state of their barracks: to the gradual operation of foul air arising from this circumstance, the predisposition to disease is more immediately to be imputed, and finally the contagious fever itself."<sup>1</sup> "It (typhus) is usually *produced* in situations where there is a want of cleanliness, and more especially of ventilation; and *when produced*, it is propagated by contagion"<sup>2</sup> (709).

823. Trotter, however, affords the most abundant evidence on this, as well as every other point concerning this disease. He states many cases in which the typhus appeared on board of ships at sea.

824. In one case, on board the Niger, he says, "It first appeared among the marines, but latterly affected the seamen. Its origin could not be exactly traced,"<sup>3</sup> &c. In another, the Glory, "We could not trace it distinctly to its source,"<sup>4</sup> &c. Of that on board the Edgar, which appeared at sea, he says, "No imported contagion was duly authenticated,"<sup>5</sup> &c.; of that on board the Pompee, at sea, "No satisfactory account could be obtained of its origin;"<sup>6</sup> of the Saturn he says, "Mr. Johnson (surgeon) remarks, 'I could not trace this fever to any infection imported by any of the people,'"<sup>7</sup> &c.; in the Magnificent, the surgeon says, the fever spread more than he had expected, "but still I cannot trace it satisfactorily to a contagious cause."<sup>8</sup>

<sup>1</sup> Currie's Medical Reports, p. 396.      <sup>2</sup> Ibid. p. 27.

<sup>3</sup> Trotter's Medicina Nautica, Vol. 1, p. 153.

<sup>4</sup> Ibid. p. 160.      <sup>5</sup> Ibid. Vol. 3, p. 63.      <sup>6</sup> Ibid. p. 64. 159.

<sup>7</sup> Ibid. p. 147.

<sup>8</sup> Ibid. p. 167.



825. In some cases the generation of the fever on board was acknowledged by the surgeon; viz. in that of the *Cæsar*,<sup>1</sup> the *Edgar*,<sup>2</sup> and the *Cumberland*.<sup>3</sup>

826. In others, it was acknowledged there was no ground even for suspicion of the introduction of the disease by contagion. Speaking of the typhus on board the *Captain*, Trotter says, "No imported contagion has been suspected here,"<sup>4</sup> &c.; of the same on board the *Uranie*, he says, "It does not appear that any imported contagion has been suspected as the cause of this fever,"<sup>4</sup> &c. Speaking of the same vessel again, he says, "It does not appear that any imported contagion could be suspected here."<sup>5</sup>

827. The result of the observation of this physician, who had for many years, as physician to the Channel fleet of England, a vast field for observation, is given thus. "It is very certain that this fever is generally spread by contagion; but it is equally certain, that it frequently *arises in places where there could be no suspicion of communication with infected persons or clothing*"<sup>6</sup> (709).

828. When we consider the firm belief in the contagious nature of the typhus entertained by Trotter, in common with all the English physicians, the great attention paid by him to the subject, and the minute inquiries in every case into the manner of the introduction of the fever on board of ships, the exceedingly slight grounds on which he is satisfied to rest his belief; this acknowledgment alone amounts to a surren-

<sup>1</sup> Trotter's *Medicina Nautica*, Vol. 3. p. 154.

<sup>2</sup> *Ibid.* p. 157. <sup>3</sup> *Ibid.* p. 162. <sup>4</sup> *Ibid.* p. 60.

<sup>5</sup> *Ibid.* p. 151. <sup>6</sup> *Ibid.* Vol. 1, p. 252.

der of the question, independently of the absurdity involved in the *double* origin of typhus. Typhus fever, therefore, is often produced, or originates in certain circumstances without the introduction of the sick, or of any other source of contagion.

829. Typhus fever never spreads even in presence of the sick, without the concurrence of an impure atmosphere (805).

830. This is fully established by observing the circumstances under which the disease arises, and the result of separating the sick from those circumstances. This disease is most prevalent in the close and filthy dwellings of the poor. "In Liverpool it has been supposed that it is seldom to be met with, and it is certainly true that the upper classes of the inhabitants are not often subject to its ravages." But "among the inhabitants of the cellars and the back houses, (built in courts) it is constantly present," so that "the number of persons under this disease who apply for relief to the charitable institutions, the public will be astonished to hear, exceeds on an average three thousand annually."<sup>1</sup>

831. But no one will be astonished at this number, when he hears what sort of habitations these cellars and back houses are. "Many of these cellars are double, and the apartments next the street have access to the external air only by the narrow and oblique aperture that forms the door, and which is of course shut during the night; and the back apartment has access to light and air only by its communication with the apartment in front; under such circumstances *the*

<sup>1</sup> Currie's Medical Reports, p. 230. 231.

*generation* of disease, and especially of contagious fever (typhus), is almost a necessary consequence.”<sup>1</sup>

832. The courts are spaces in the interior of the squares built closely round with houses, with access to them through a narrow arched way. An idea may be formed of these places from some recommendations in a report of the physicians to the corporation of Liverpool. They advise, that power should be obtained to compel proprietors of courts to give them the ventilation of a thorough draught of air, implying that they have it not. We gather from this report that the courts are very narrow; that the entrance is through an arched way; that the houses are frequently above two stories high; and that the upper end of the court is shut.<sup>2</sup> The size of one of them is given. It is fifty-four feet long, seven feet ten inches broad, and contains eight small houses, four on each side, the doors fronting each other, and opening into the court. It communicates with the street by a covered passage twenty-six feet long, and only two feet ten inches wide; and this is the only exit or entrance.<sup>3</sup>

833. The streets infested by typhus fevers have numerous collections of standing water, including filth of every kind;<sup>4</sup> and in those streets which are not drained, and in which dung-hills are suffered to accumulate, the fever prevails most.<sup>5</sup>

834. On removing the sick from these filthy neighbourhoods, and confined habitations, the fever expires.

835. Dr. Currie, speaking of the Liverpool work-

<sup>1</sup> Currie's Medical Reports, p. 248.      <sup>2</sup> Ibid. p. 249.

<sup>3</sup> Ibid. note to p. 284.      <sup>4</sup> Ibid. p. 247.

<sup>5</sup> Ferriar's Medical Histories, p. 226.

house, says, "The wards for fever at the work-house, have in general secured that immense hospital, often containing twelve hundred persons, from the spreading of fever, to which previous to their establishment it was perpetually liable; and though they are in the very centre of the building, and cannot be entered but through the common staircase, (crowded every day with children, 808) yet no single instance has occurred of the contagion (the fever) extending from them into the other parts of the house."<sup>1</sup>

836. "It is clear from the collected observations of Dr. Haygarth, and of those active and experienced physicians whose correspondence he has published, not to mention the experience which fever wards have lately afforded, that in a large airy and clean apartment, *few or none even of the most intimate attendants catch the disease*, where the patient labours under infectious fever. The nurses themselves, exposed to the effluvia of the excrements, and perpetually near and often in contact with the sick, nevertheless hardly ever receive infection. The atmosphere of a room where contagion is generated, if cleanliness and ventilation be employed, may therefore be breathed for a long time with impunity."<sup>2</sup> How long, may be gathered from what Dr. Currie states, that, of the nurses who slept every night in the very centre of the fever patients, in apartments exposed to the atmosphere of the wards, because open at the top, and who were often, and for a considerable time together in contact with the bodies of the sick, and exposed to the undi-

<sup>1</sup> Currie's Medical Reports, p. 243.

<sup>2</sup> Rees's Cyclopaedia, article Contagion.

luted exhalations from their skin and lungs, in ten years only one died, and she was upwards of sixty and otherwise infirm.<sup>1</sup>

837. On the one hand, in the confined air of the miserable abodes of the poor, the fever is produced, and for ever kept alive, though thousands are annually sent from them to people the hospitals. On the other hand, in the purer air of a well kept hospital, it is for ever expiring; and were it not for these thousands annually sent to the fever wards, they would soon be empty.

838. We find then that typhus fever is destitute of the characteristics of a contagious disease, viz. that of affecting a person but once; and that of spreading until it become universal, even in the circumstances favourable to its extension, unless stopped by insulating the sick (803. 804).

Moreover, typhus fever often appears in such circumstances that it is evidently impossible that there could have been any communication with the sick (820 to 827); in persons placed near the sick, the disease is very often not produced (807 to 818), and it never prevails without the presence of those circumstances, which are sufficient at any time to produce it (830 to 837). But the ground of our belief in the propagation of a disease by volatile contagion, being, that it is produced by exposure to the sick, without any other possible means of accounting for the phenomena, and never without such exposure (707. 708), we are in this case utterly destitute of it, and must conclude that typhus fever is not propagated by a volatile contagion.

<sup>1</sup> Letter to Dr. Clarke.



839. The doctrine of the contagious nature of typhus fever, rests solely on the circumstances, of the disease sometimes prevailing after persons affected with it have been introduced into a place, and of many being affected in succession, whence it is inferred that they communicate it to one another.

840. The circumstance of the sick becoming so *in succession*, has been relied on as positive evidence of the contagious nature of this disease, is stated as the ground of the belief in some of the reports of the surgeons of the English Channel fleet to Dr. Trotter, is the only ground mentioned in some cases, and is received by him as evidence, without remark, although he was in the habit of freely remarking on points in which he differed from them.<sup>1</sup>

There is however nothing whatever in this circumstance pointing to the *nature* of the cause. Whatever it be, it must produce its effects in succession, inasmuch as the degrees of liability to be affected, arising out of difference of constitution, and of degrees of exposure, are infinitely diversified.

841. With regard to the other circumstance, of the disease sometimes prevailing after persons affected with it have been introduced into a place; it is certain that it very often does not follow the introduction of the sick (807 to 818, particularly 816), that it very often originates in certain circumstances without the introduction of the sick (820 to 827), and that out of these circumstances the disease ceases to spread, even in presence of the sick (830 to 837.) It is therefore most evident, that the propagation of the disease does

<sup>1</sup> *Medicina Nautica*, Vol. 3, p. 218.

not depend on communication with the sick : and therefore the cause does not emanate from them, and consequently is not contagion (700).

842. It may perhaps be thought that one ground for believing in the contagious nature of these fevers has been omitted, viz. that of a person's being affected by going among the sick. This, however, is no proof whatever of the contagious nature of a disease. Whatever be the cause, those who go where it is in force, will be liable to be affected.

If a person be affected by going into a place where a disease is prevailing, and approaching the sick, the question arises, to which is the disease to be attributed, to a cause produced by the circumstances, or to one emanating from the sick? To determine this question, separate the two alleged causes. If the sick, removed from the circumstances, produce the disease, it is by something emanating from them, and the disease is contagious. If not, and reverting to the circumstances, it be found that those are affected who are placed in them, while the sick are not present, it is evident that the cause proceeds from the circumstances, and not from the sick ; and the disease is not contagious.

Now this has been tested times without number. Separated from the circumstances in which they prevail, there is no danger in going near a person affected with yellow fever, plague, or typhus fever (747, &c. 792, &c. 834, &c.) ; but there is in going into the circumstances in which these diseases prevail, though you do not go near the sick (742. 771. 824, &c.).

We shall now proceed to inquire into the nature of the cause generated in these circumstances.

## CHAPTER XI.

### ORIGIN OF THE PLAGUE.

843. We have seen that a peculiar state of the air is necessary to the prevalence of the plague; *without which it ceases to spread* (789.) In order to ascertain in what this state consists, let us consider the circumstances in which the change, from the ordinary to the peculiar state of the air, takes place. It will clearly appear from the consideration of the state of those places in which the plague has from time to time prevailed, and of the weather during the time of its prevalence, that these circumstances are those in which miasmata abound.

844. Many parts of Europe were formerly desolated by the plague. Immense numbers died; in some instances, by the accounts we have received, to the extent of one half or three-fourths of the population of the places afflicted. This, incredible as it may seem, is not at all improbable if we consider the state of the country, the manners of the people, their habits of living, and the dreadful treatment of the sick through fear of infection, with the absurd or inadequate means used for their relief.

845. That continent was divided into an immense number of petty states; all of which, and even the lords of a single castle, almost innumerable, waged war, and committed the most abominable and unceas-

ing devastations. Thus was property insecure ; and no man having any assurance that he should reap the fruits of his labour, the earth was badly cultivated, and the wet and marshy parts left in their natural state ; and even those parts which in former ages had been reclaimed, were suffered to relapse into their original state.

846. The towns of Italy, particularly those on the Po, and its branches, were formerly ravaged by the plague. In those times, these towns were subject to be overflowed by the annual inundations proceeding from the melting of the ice of the Alps. In later times, they have been protected by embankments, and the country is well drained and cultivated, and they have suffered less from epidemics.

847. In Germany, Augsburg, Dresden, Ratisbon, and Presburg, in Hungary, formerly ravaged by the plague, are situated on rivers, one of them between two rivers, and another divided into two parts by a river.

848. Holland was almost continually harassed by the plague, insomuch that the English were in the habit of attributing that disease, when it prevailed with them, to the introduction of contagion from Holland. That country was formerly "much more liable to inundations, and to stagnation of water than it is at present."<sup>1</sup> The towns are situated on marshy rivers, many of them surrounded with stagnant water, and having canals running through the streets. The plague sometimes broke out in the towns which were not maritime. Diemberbroeck states, that, in 1663, the

<sup>1</sup> Pringle on the Diseases of the Army, p. 323, note.

plague prevailed in Heusden, on a branch of the Meuse, surrounded by a morass; which was not a maritime place.<sup>1</sup>

849. England, a country abounding with streams, with meadows, and marshes, and formerly much more so than at present, was often ravaged by the plague. It is stated to have prevailed several times in the 17th century, for several years in succession; as from the year 1606 to 1609, inclusive, and from 1636 to 1648.<sup>2</sup>

850. The city of London stands in a low situation. The banks of the Thames, which runs through it, were formerly marshy; and marshy streams ran through the city into that river. Westminster was formerly separated from the city by a bog or morass, where the Strand now is; the name implying something of the kind. The Bank is built partly on piles, over the spot where one of these streams formerly ran. The fens of Essex are not far off, and the wind frequently blows over them upon the city.

851. Before the great fire in 1666, the city consisted of numberless small buildings, without arrangement, the streets being crooked, narrow, and filthy. The habits of the people of those days were very different from what they now are. Erasmus, in a letter to a friend respecting England, says, "The floors are commonly of clay, strewed with rushes, under which lies, unmolested, an ancient collection of beer, grease, fragments, bones, spittle, excrements of dogs, cats, and every thing that is nasty,"<sup>3</sup> &c.

852. The great fire of 1666 destroyed the miserable

<sup>1</sup> Webster's Hist. of Pestilence, Vol. 1, p. 200.    <sup>2</sup> Ibid. p. 173. 185.

<sup>3</sup> Caldwell's Memoirs, p. 171.



hovels with which the city abounded, with their accumulated impurities, and gave an opportunity for the erection of larger buildings, with wider streets, and more room for the air to pass and disperse every exhalation that might arise. The city has been provided with sewers that carry off that filth and moisture which formerly stagnated above ground ; and the marshy banks of the Thames, and the country in every direction around for ten miles, is highly cultivated.

853. That this is the true reason of the exemption of London from the plague since that time, appears from the following considerations : the same malignant fevers which always preceded the plague, have appeared since the fire, but have never arisen to the same height ; these malignant fevers have gradually moderated as that city improved in the above mentioned respects ; and at the present day, when the city has become extremely clean, these diseases are little known, except in those obscure, confined, and filthy parts, which still resemble what the whole formerly was. In the time of Pringle, “in some of the lowest, moistest, and closest parts of the town, and amongst the poorer people, spotted fevers and dysenteries were still to be seen, but were seldom to be heard of amongst those of better rank, living in more airy situations.”<sup>1</sup>

854. Thus we see that the situation of the places in Europe, in which the plague formerly prevailed, was such that miasmata must have abounded in hot summers. It will further appear from the following table that this disease uniformly increased as the temperature of the season advanced, was at its greatest height when

<sup>1</sup> Pringle on the Diseases of the Army, p. 335.

the temperature was highest, and declined as it declined. The first row of figures indicates the year; the figures opposite to the names of the months, indicate the number that died in that month in each year, in London. The last column contains the numbers that died of the plague at Dantzic, in 1709.<sup>1</sup>

	1593.	1603.	1625.	1636.	1665.	1709.
April	138	26	85	37	2	
May	167	83	224	162	43	
June	468	362	954	440	1060	319
July	2930	2999	5887	456	5667	1313
August	2880	8919	16455	1239	17036	6139
September	2200	12504	9979	3856	31569	8303
October	1260	4012	1514	2786	9444	4932
November	710	1352	256	2602	3449	1961
December	290	324	37	640	734	584

855. Here we see the mortality keep pace with the increase and decrease of the heat of the season, with just such occasional variations as we know occur in the temperature of different summers; just such as have occurred in our epidemics, connected with known variations of temperature. Thus, in 1793, in Philadelphia, the fever was on the increase in September, and was at its height in the second week of October; but in 1798, it was suddenly checked in every part of the city on the 29th of September by frost. So, in the above account, the disease was at its height in London in September, in three years of the five given; but in 1593, and more particularly in 1625, the mortality of that month was inferior to that of August.

It is further to be observed, that the summer of 1665, in which the greatest mortality occurred, was uncommonly hot and dry.<sup>2</sup>

<sup>1</sup> Russel on the Plague, p. 276.

<sup>2</sup> Bancroft on Fevers, p. 404, note.

856. It is evident from these facts, that the plague, formerly prevalent in Europe, appeared in low and marshy situations, and in hot weather; that is, in situations and circumstances in which miasmata must have abounded.

857. The same is evinced in the clearest manner, by the present state of the countries of Africa and Asia in which the plague still occasionally prevails. Many of these are still in the situation in which Europe formerly was; the country badly cultivated, the cities crowded to the utmost excess, and the bulk of the population very wretched and dirty in their diet and manner of living. "Prosper Alpinus, (*De Med. Ægyptior.* lib. 1, cap. 13.) says, an almost infinite number of the Egyptians, impelled by poverty and want, fed upon the worst kind of aliment, and drank muddy and putrid water, at Cairo."<sup>1</sup>

858. Lower Egypt is a rich flat country, intersected by the different branches of the Nile, by numerous and extensive canals, mostly in a ruinous condition, and by a number of lakes, some of them formerly branches of the river, but now obstructed and stagnant. The towns are surrounded by flat grounds, which after the inundation become extensive marshes.

859. Damietta has the lake Menzaleh on the north, and is divided by the Nile into two parts. There are fields of rice around this city; and there are several lakes, pools, and marshes, in its environs.<sup>2</sup>

860. Alexandria, on the east and south, has the lakes Mareotis and Madiez.<sup>2</sup> It has low places and sunken holes in the city itself. The water of the Nile

<sup>1</sup> Medical Repository, Vol. 4, p. 195.

<sup>2</sup> Assalini, p. 69.

is kept in stagnant reservoirs during the year for family use, and sometimes becomes "poisonous before it is consumed."<sup>1</sup>

861. Cairo is situated in a plain at the foot of a mountain : through the midst of it runs a great canal, into which the inhabitants, who are excessively crowded in their habitations, throw every kind of offal. Into this canal the water is let when the Nile rises to a certain height, and it gradually dries up after the river retires to its bed. Prosper Alpinus "mentions the canal of Cairo as an abominable nuisance, as becoming charged with abundance of putrefying things, changing from green to black, and becoming horribly stinking, and destroying the lives of persons living near it."<sup>1</sup>

862. The Nile begins to rise in June, and by degrees overflows the whole flat country, which continues covered until the last of September or first of October, and it is quite wet until the last of October,<sup>2</sup> and perhaps later. The inundation is least near the coast (450), but there heavy rains fall.

The temperature of the atmosphere in this country is very high ; "from the end of February, the heat, even at nine o'clock in the morning, is hardly supportable by an European." As the summer advances, the winds from the deserts are excessively hot and dry, so that "the air is inflamed, the sky sparkling, and the heat oppressive to all that are unaccustomed to it."<sup>3</sup>

863. This country is exceedingly unhealthy. Fe-

<sup>1</sup> Medical Repository, Vol. 4, p. 195.

<sup>2</sup> Assalini, p. 131.

<sup>3</sup> Rees's Cyclopaedia. Egypt.

vers and dysenteries appear in the fall as soon as the sun can operate on the drenched earth. Malignant fevers break out every year in the cities Damietta, Alexandria, and Cairo. In short, it is a country so often the seat of pestilence, that it has been pitched upon by a celebrated author as the fountain-head of the plague, whence it has spread over the earth.<sup>1</sup>

864. Fevers of a grade comparatively mild appear in the month of September. But the inundation being still over a great part of the country, and some of the squares of Cairo being under water, even until the last of October,<sup>2</sup> the heat at the same time declining, it is not until March that the plague appears. By this time the temperature, never lower than 37 degrees in the morning,<sup>3</sup> throughout the winter, is rapidly increasing with the return of the sun to the north, and operates upon the earth still moist, and upon the low places. The disease increases with the increase of the temperature, rages during March, April, and May, when the southerly winds make it very hot,<sup>4</sup> but terminates about the last of June, before the temperature is near its greatest height, which is in August.<sup>5</sup> This anomaly strongly corroborates the truth of the doctrine, that the plague also is occasioned by the operation of heat and moisture on vegetable matter, or the filth of cities.

865. The water having returned to the bed of the river in the autumnal season, the country gradually dries through the winter and spring, and early in July even the *lake* Mareotis is nearly dry. That this is

<sup>1</sup> Mead on the Plague, p. 30. 31.      <sup>2</sup> Assalini, p. 131.

<sup>3</sup> Assalini, p. 11.      <sup>4</sup> Pringle on the Diseases of the Army, p. 193.



usual we infer from an expression of Assalini, that the lake Mareotis was not yet dried up on the 7th of July, in 1798.<sup>1</sup> From this we may judge how completely dry the marshes and the country generally must be by this time. Thus it appears as the country dries up the plague declines, and ceases when it is entirely dry.

866. It may be said that the plague, according to authors, is over in Egypt by the last of June.

It is very true that it is so far extinct by that time, in general, that Europeans, who live shut up during the prevalence of the disease, come out of their confinement; but cases still occur, and sometimes in such numbers, that they continue shut up even until the middle of July. This was the case in Cairo in the year 1759;<sup>2</sup> and, in the year 1798, when Assalini found the lake Mareotis *not yet dried up*, the Europeans in Alexandria were still shut up in their houses, that city having just been visited with the plague, and continuing still unhealthy.

867. The cessation of the plague has indeed been attributed to the inundation of the Nile occurring at this period.<sup>3</sup> Were this the case, it would be equally effectual with perfect dryness, in putting an end to the production of miasmata (156); but it is not so. The rise of the river is very gradual; all parts are not covered at once; the parts about Alexandria are not so deeply covered as those above; and the water is not let into other parts until late in the season. Thus Assalini says, on his arrival at Alexandria he encamped on a dry, barren, and scorched soil, on the 5th

<sup>1</sup> Assalini, p. 4.      <sup>2</sup> Russel on the Plague, p. 2. 266, note.

<sup>3</sup> Philadelphia Journal, &c. No. 16, p. 359.

of July, marched for Cairo on the seventh along the banks of the Nile, and arrived there on the 23d; the river continued sensibly to overflow, and on the 19th of August the dikes were cut to allow the water to enter into the squares and gardens of Cairo.<sup>1</sup>

868. From the above it is manifest, that the continuance of the plague beyond the last of June, at Alexandria, coincides with the continuance of the moisture in the neighbouring lake; while the expression, "*still shut up*" on the seventh of July, and the fact that Europeans have never found it necessary to continue shut up beyond the middle of that month, connected with the expression, "*not yet dried*," and the fact that the whole country around was dry, excepting only the bottom of the lake, all show that the plague commonly terminates, and the lake is commonly dry, by that time of the year.

869. The case of Cairo is stronger still. Assalini found it hotter by some degrees than the lower parts of Egypt. The Europeans there also usually come out of confinement on the 24th of June.<sup>2</sup> But the water is not let into the canal until about the 19th of August;<sup>1</sup> long after the plague has ceased. The canal at this period, just previous to letting in the water, is perfectly dry, and is used as a street.<sup>3</sup>

870. It is evident from this account, that the plague not only appears in situations in which miasmata abound (856), but that it ceases in the very same circumstances in which miasmatic diseases cease; viz. in cool countries on the arrival of winter, and in hot coun-

<sup>1</sup> Assalini, p. 6.

<sup>2</sup> Russel on the Plague, p. 2.

<sup>3</sup> Rees's Cyclopaedia.

tries in extreme dryness ; the plague ceasing in London in the first cold weather, as miasmatic diseases do (854) ; and in Egypt in extreme drought, as the diseases from miasmata also do in Senegal (484).

871. Assalini gives an account of the situation, &c. of Jaffa, where the plague raged in 1799. There are near the town several ponds or marshes. The French army, on its arrival at Jaffa, encamped close to three of these ponds ; and soon after were distressed by the plague.<sup>1</sup>

872. It is stated by Dr. Cowdery, who was some time a prisoner at Tripoli, in a letter to Dr. Mitchell, that that city had in former years been infested with the plague, but was at that time, 1805, remarkably healthy.<sup>2</sup> This city stands in a sandy and barren desert. On inquiring into the cause of this “among the oldest of the Divan, I understood, that at the time of the plague a large foss, or ditch, was dug at the foot of the south and east ramparts of the city, which in the rainy season was filled with water, and was intended to prevent the enemy’s scaling the walls ; they said that the water in this ditch produced a very offensive smell during the hot season, and that the Bedoweens, who encamped on the borders of it, were the first sufferers ; that they mostly perished, and were buried in heaps in the encampment. They informed me, that the rains in winter, and the winds in summer, had filled the ditch with sand, since which they had enjoyed health,”<sup>3</sup> &c.

873. All these statements unquestionably confirm the doctrine here advocated. It is equally well sup-

<sup>1</sup> Assalini, p. 7. 8.    <sup>2</sup> Med. Repos. Vol. 9, p. 155.    <sup>3</sup> Ibid. p. 158.

ported by Russel's account of the plague in 1760, 1761, and 1762, in Aleppo.

874. Aleppo is situated on a number of small hills, with intervening valleys, and a considerable portion of flat ground. There was formerly a broad ditch around it, which in 1760 was partly filled up, and occupied as garden ground. A small river runs through the city, from which the gardens are supplied with water by drains. It occasionally overflows its banks, and in this way, on one occasion, broke up a camp of besiegers. This stream of water in great rains necessarily fills the low places, and renders damp the subterranean habitations, of which there are very many. The population is very great, and very crowded and filthy. The houses of the Jews, who are most severely affected, are small, or if large, the different apartments are crowded with different families. Many of the houses are more than a story below the level of the street, in a condition half ruinous, dirty in the extreme, damp, and badly aired. "It was not without horror I descended into these dreary mansions," says Russel.<sup>1</sup>

875. The climate is very hot and dry, so that by the end of May the grass is generally burnt up;<sup>2</sup> and from the end of the month of May until the fall of the year, there seldom is a day's rain. From this state of things we might expect an annual epidemic of more or less violence, and accordingly Russel speaks of an ordinary epidemic, which, without question, is the bilious remittent and intermittent fever of hot countries. There occurs, however, now and then, an epidemic

<sup>1</sup> Russel on the Plague, p. 64.

<sup>2</sup> Ibid. appendix, p. cxxviii.

more general in its influence, and more fatal in its effects. This it is which has been called the plague. We shall be able to show from the facts recorded in Russel's valuable treatise, that this formidable disease is regulated in its rise and fall, increase and decrease, by the same circumstances which govern other hot weather epidemics.

876. The plague prevailed in Aleppo in 1760, 1761, and 1762, and did not in the years immediately preceding and following those years. The following tables will assist in the explanation of this difference. They are taken from Russel's two tables of the temperature, and of the variations of the barometer, and the quantity of water that fell in each month. In the first table, the first number opposite to the name of each month, is the highest degree observed during the month in the afternoon; the second, the lowest observed in the morning. In the second table (878) are stated the days of rain and snow, in the different years mentioned.

877. In	1759.	1760.	1761.	1762.	1763.
March	60°	60°	59°	59°	62°
	38°	38°	43°	46°	46°
April	71°	68°	78°	66°	
	53°	47°	49°	55°	
May		80°	82°	82°	
		62°	55°	65°	
June	94°	89°	89°	89°	89°
	69°	69°	70°	65°	66°
July	95°	94°	95°	94°	94°
	71°	75°	78°	73°	74°



878.	In 1759.	1760.	1761.	1762.	1763.
Days of rain in } Jan. and Feb. }	18	31	23	28	17
March	9	18	14	10	11
April	4	9	9	6	11
May	1	10	5	6	1
June	0	1	1	4	2
July	0	0	0	0	0
Total	<u>32</u>	<u>69</u>	<u>52</u>	<u>54</u>	<u>42</u>

879. From these tables we see that the heat varies very little in the different years; but the variation in the quantity of rain is striking. The difference is great throughout, the sickly years being much the wettest; and it is especially to be observed, that the excess of rain in the sickly years was particularly great in the hot months of May and June, when the thermometer was as high as 80 degrees in the former, and 89 degrees in the latter. Heat and moisture, therefore, did not occur together in the years 1759 and 1763, in so great a degree as they did in 1760, 1761, and 1762, and the plague appeared in the latter years, and not in the former.

880. The very same thing is observable in comparing the plague years 1743 and 1744, with the five years above mentioned. The year 1742 was also a plague year, but the days of rain of that year are not given.

The average of the days of rain and snow in the first three months of the plague years 1743 and 1744, was  $23\frac{1}{2}$  days; of the healthy years 1759 and 1763,  $27\frac{1}{2}$  days; of the plague years 1760, 1761, and 1762,  $41\frac{1}{2}$  days.

The average of the two warm months, April and May, of the plague years 1743, 1744, was  $13\frac{1}{2}$  days; of the healthy years 1759, 1763,  $8\frac{1}{2}$  days; and of the plague years 1760, 1761, and 1762, 15 days.

Although the moisture in the three first months of 1743 and 1744 did not even come up to that in the same time of the two healthy years, the weather being cool, it did not make much difference; but in the warm months, when there was heat to co-operate with the moisture, the days of rain in these two plague years were nearly two-thirds more than in the two healthy years, and nearly as many as in the three plague years.

881. The plague commenced later, and was less severe in 1760 than it was in 1761. The quantity of rain which fell was very great in both years, but more particularly in 1760, insomuch that the spring of this year was in an extraordinary degree wet and cold.<sup>1</sup> The spring of 1761, though wet, was much warmer; the weather having been serene and pleasant from the middle of February, with the exception of a spell of cold weather in the latter part of March and beginning of April.

Hence it was that the plague did not make its appearance in 1760 until the middle of May; whereas, in 1761 it appeared early in April.

For the same reason it was lighter in 1760 than in 1761; the same difference in the temperature continuing through June and July.

882. If it be objected that the table, though it shows the temperature of 1761 was higher than that

<sup>1</sup> Russel's Treatise, appendix, cliii.

of 1760, does not show a very great difference; it may be observed, that, in this table, the highest and the lowest degrees in each month are marked. Now, if a month be cool for the greater part, and suddenly become warm, as often occurs, this mode of marking the temperature will not give a correct idea for the whole month. The above account is taken from a full statement of the weather made in the appendix. This could not be followed in comparing the whole five years, as no account is given of 1763, and the table was therefore used.

883. The plague was also more severe in 1762 than in 1761, and commenced earlier in the former year.

There was about the same difference between these two years as there was between 1760 and 1761. The number of days of rain in March, 1760, was eighteen; March, 1761, fourteen; and March, 1762, ten. The spring of 1760 was "wet in an extraordinary degree, and cold;" that of 1761 wet, with a very cold spell in March and April; and that of 1762 not so wet, and warmer, there being no such spell in March and April.

From the middle of February the two years were much alike;<sup>1</sup> but in the last fortnight of March, 1761, there was much rain, and the weather became remarkably cold and wintry;<sup>1</sup> and this spell of weather continued until the eleventh of April.

In 1762 there was no such spell in March and April. The usual height of the thermometer in the morning was ten degrees higher in 1762 than in 1761 during this spell.<sup>2</sup>

884. The number of deaths corresponded with this marked state of things.

<sup>1</sup> Russel's Treatise, appendix, p. cxli.      <sup>2</sup> Ibid. p. cxxxiv.

Deaths. April 6th to 13th, to 20th, to 27th, to May 4th, to 11th, to 18th, to 25th, to June 1st, to 8th,									
In 1761	58	88	125	113	171	139	177	290	670
1762	165	240	205	257	303	254	296	579	710

Here we see not only the gradual increase of the disease in both, as the heat increased; but the effect of the cold spell in the end of March and beginning of April, on the number of burials in 1761 in comparison with the greater number in the same period of 1762, when there was no such spell; and the increase of the *proportion* of deaths in 1761 after that spell was over, and the weather became warmer, until in the first of June they were nearly equal.

885. The temperature was so nearly alike in the summers of 1761 and 1762, that no material difference could have arisen out of it. The quantity of rain only is therefore mentioned in the following statement; and the correspondence between the mortality and the quantity of moisture in a high temperature is evident.

In 1761	Week ending	Died.	In 1762	Week ending	Died.
June	8	670	June	7	710
	15	543	A shower fell this week.		
	22	505		14	874
Some showers in the 2d week.			Great rains in the 2d week.		
	29	612		21	1208
	27	236		28	1273
July	6	708	July	5	1472
	13	483		12	998
	20	296		19	506
	27	236		26	379
August	3	102	August	2	232
	10	110		9	136
	17	90		16	112
	24	108		23	71
	31	66		30	68

886. The effect of the heavy rains in the second week of June 1762 is striking. The deaths immediately began to increase, and in the first week of July were more than double the number in the first week of June, just before the rain; while the deaths in the corresponding period of 1761, there being very little rain, increased very little. It is worthy of observation, also, that little as this increase was, it occurred in about the same time after the fall of the rain with the greater increase of 1762; both rains having occurred in the second week of June, and the greatest mortality in the first week of July. From that time also in both years the disease began to decline, no rain having fallen from the second week in June, except a very slight shower on the eighteenth of August in the latter year. The great heat continuing about eighty days without any fall of rain, the disease almost disappeared; the number of burials having fallen from 708 in the first week of July, to 66 in the last week of August; and from 1472 to 68 in the corresponding weeks of 1762.

887. From all this it plainly appears, that in that hot climate, the wet years are those in which the plague makes its appearance, and the dry ones are free from it; 2, that while there is moisture to co-operate with the heat, the disease increases with the increasing temperature of the summer; 3, that when the moisture fails, though the heat is increasing daily, the disease disappears; 4, that a fall of rain, in these circumstances, revives the disease.

888. Let us now compare the plague of 1762 in Aleppo with the rise and progress of this disease in a



colder climate. The following is a statement of the weekly deaths in the plague in London in 1665, and in 1762 in Aleppo, commencing with the first week in April.<sup>1</sup>

Week ending on		London in 1665. Aleppo in 1762.	
April	7	0	165
	14	2	240
	21	0	205
	28	0	257
May	5	9	303
	12	3	254
	19	14	296
	26	17	579
June	2	43	710
	9	112	874
	16	168	1208
	23	267	1273
	30	470	1472
July	7	725	998
	14	1089	506
	21	1843	379
	28	2010	232
August	4	3817	136
	11	3880	112
	18	4237	71
	25	6102	68
September	1	6988	66
	8	6544	42
	15	7165	48
	22	5533	68
	29	4929	

<sup>1</sup> Russel on the Plague, p. 276.

Week ending on		London in 1665. Aleppo in 1762.
October	6	4327
	13	2665
	20	1421
	27	1031
November	3	1414
	10	1050
	17	652
	24	333
December	1	210

889. These tables show in the plainest manner the operation of the principle advanced.

From the spring of the year, and throughout the summer in Aleppo, there is heat enough, but moisture only in the spring.

In London there is moisture throughout, but heat enough only in summer.

In the latter, the disease appeared not in the spring for want of heat, but raged in summer, and continued as long as the hot weather continued, and declined when the heat declined.

In the former, as long as there was moisture, the disease increased with the heat as in London; but when there had fallen scarce any rain for months, in the extremity of the drought the disease disappeared, though the heat was still increasing.

In the hot and dry climate of Aleppo, the increase and decrease depended on the rain that fell; in the cool moist climate of London, on the heat of the season.

In the former, the disease ended in August during extreme heat, for want of the co-operation of moisture; in the latter, in December, during abundance of moisture, for want of the co-operation of heat.

890. The same is as clearly shown by a comparison of the circumstances in which the plague prevails and ceases in Aleppo and in Egypt. It appears in both while the earth is wet and the weather hot, prevails as long as the moisture continues, and ceases in both in hot weather, at the moment that the country is dried up ; and the certainty that the cessation is the consequence of the absence of moisture, is shown by the cessation of the plague, as soon as the country is perfectly dry, at different periods of the hot weather, viz. in June in Egypt, and in August in Aleppo.

891. It is evident, therefore, that the plague prevails in the very same circumstances in which hot weather epidemics, in all parts of the earth, prevail, viz. those in which miasmata abound ; that, like them, it increases as the circumstances of heat and moisture become more and more favourable to the production of miasmata ; that it ceases, as they do, when the production of miasmata fails, either through deficiency of heat, as on the approach of winter in London, or through excess of heat producing dryness, as in Aleppo and in Egypt ; and therefore we have the same reason for believing it is produced by miasmata, that we have for believing other hot weather epidemics are thus produced.

892. This is confirmed by observing that the effects produced in both cases are alike ; or, that the symptoms of plague and of autumnal remittents in every part of the earth are the same, *there being no essential difference between them*. This is evident from Russel's account of the plague in Aleppo.

893. He divides the cases into six classes. In the

first, the sick were sometimes suddenly attacked with loss of strength, confusion or weight in the head, giddiness, oppression about the præcordia, and dejection of spirits: they were silent, anxious, but complained little: having little or no fever, those about them frequently considered them as but slightly indisposed. These perished within the twenty-four hours, sometimes the second or third day. They had neither buboes nor carbuncles, and it was very rare to find suspicious marks of infection on the dead bodies.

Some of these in a few hours had muddy eyes, the surface of the body cold; they became drowsy and lethargic, and complained of pain at the heart. "As the distemper advanced, they often lost the power of speech, the skin seldom recovered heat, or, if it did, it was in irregular flushings of short continuance, which soon gave way to cold clammy sweats. The pulse sometimes remained nearly in its natural state, but for the most part was low and quick. They were by turns delirious, confused, and sensible; but the comatous disposition was the most prevalent. Towards the end they suffered incessant inquietude.

Some had a vomiting the first night, in others a diarrhœa supervened the next day, both or either accelerating the fatal period; but these symptoms were less frequent than in some of the other classes.

Buboes appeared in none, except in a very few, who survived the third day. Carbuncles were rarely met with sooner than the month of May, which was later than the period when this form was predominant. Petechiæ, vibices, or broad livid roundish spots, occurred sometimes, but were not common, and the two latter were seldom visible until after death."

894. In the second class, "The disease began generally with a slight shivering or sense of cold, which was soon succeeded by fever, accompanied with giddiness, head-ach, vomiting, and sometimes looseness. The fever increasing in the night, the face flushed, the eyes glistened, and the patient either grew delirious, or became drowsy and comatous. The pulse in this stage usually continued full and strong; the thirst was excessive, though the tongue was not parched; but the stomach retained little of what was drank, and the patient, harassed by the vomiting and other symptoms, passed a very unquiet night.

Towards day-break, the fever abating, the sick grew more composed. Where they had been delirious in the night, they usually recovered their senses in the morning, and did not lose them again in the subsequent exacerbations through the day; though sometimes disposed to ramble a little or to talk incoherently. Where they had been comatous in the night, the morning remission was less distinct, the lethargic disposition remained, and either increased in the exacerbations, or alternated with delirium, so that they continued drowsy or rambling all day.

The pulse in the morning still kept up, more or less full, and the external heat was moderately feverish, but the skin for the most part was dry. The patient, though less unquiet, was more dejected. As the day advanced the pulse began to alter, and other symptoms characteristic of infection succeeded, though not in a regular series, or in all with equal rapidity; their accession seemed to be hastened by the vomiting; as also by the diarrhœa, which frequently supervened at this time.



The principal symptoms here alluded to were the muddy eyes and peculiar confusion of countenance ; a low quick equal pulse ; sometimes low and fluttering, rarely intermittent ; the tongue whitish, often unaltered, and rarely parched ; the external heat moderately feverish, at other times intense, in irregular flushings ; pain at the heart, or oppression about the præcordia ; burning pain at the pit of the stomach, and incessant inquietude.

The oppression at the præcordia, and burning pain at the pit of the stomach, were sometimes complaints from the first night, but are joined with the other symptoms referred to the second day, as being more generally the time of their appearance.

The progress, more or less rapid, of the symptoms above recited, denoted more or less danger ; but when to these were joined a faltering in the tongue, or loss of speech, while the surface of the body, losing its natural or feverish heat, became cold and damp, with clammy sweat, death was then impending and inevitable, though perhaps the fatal moment was still at some distance.

In the evening of the second day the syndrome of symptoms became more and more alarming. As the night advanced all grew worse, and if towards morning the patient appeared to lie more quiet, it seemed owing less to a change to the better, than to his strength being exhausted by the dreadful inquietude of the preceding eight hours.

It sometimes happened, where the vomiting had ceased or abated early, that there was a tolerable remission on the morning of the third day, which revived

the expiring hopes of the assistants ; but the calm was always fallacious, and of short duration ; the exacerbations returning with equal or increased vigor, while the enfeebled powers of nature became less and less able to resist.

“In some, especially where the debility had been hastened by vomiting, looseness, or hemorrhage, the third day proved fatal ; but the disease more commonly was protracted two or three days longer ; advancing so far regularly to its termination, that each night afterwards proved worse than the precedent, and in the day, the intervening calms or remissions were so transient and obscure, as to leave no room for hope. None of the sick in this class recovered, whether the disease was left to itself or treated methodically.

“The course of the buboes was of no material consequence. They made their appearance commonly the second day, oftener the third, and sometimes later ; a very small proportion were without eruptions. But the buboes never approached to maturation here, and their advancing or not, were circumstances which had no visible effect in hastening or retarding the termination of the disease.

“Carbuncles, though more frequently met with than in the former class, were not common ; and where they occurred, the suppuration sometimes began around the edges of the black crust, which rarely had time to cast off ; but they very often continued to spread, or, where the gangrene stopped, remained dry and shrivelled.

“*Petechiæ* and *vibices* were sometimes met with. Livid marks on the corpse were more frequently observed than in the first class.”

895. "The difference between the third and second class, consists in the absence of vomiting at the beginning; the later accession of coma and other bad symptoms; and a slight tendency to perspiration, which very rarely occurred in the second." "It is certain that from the second or third night the course of symptoms, in both classes, varied very little, and the termination of the disease was in both the same; it may be added, that they reigned together through all the periods of the pestilential season, but were most prevalent in its augment; for at its height, and in its decline, they gave place to varieties of the disease less destructive."

896. "The fourth class was the most numerous of all."

"The distinctive marks of this class are, the continuance of the inflammatory or febrile symptoms with less interruption than in the former; a pulse more constantly sustained, or soon recovering itself, when sunk and hurried in the exacerbations; the length and rigour of the exacerbations decreasing in the advance of the disease; and, above all, the prevalent tendency to a favourable discharge by the skin, with the critical sweats on the third, fifth, or subsequent days."

"The phenomena attending the access of the disease, varying in degree, were nearly the same as described in the two former classes; vomiting was a concomitant in about one-fourth part of the sick. The fever, for the most part, was very moderate the first night, very rarely accompanied with delirium, and almost never with the comatous disposition.

"From the vigour or sluggishness of the access,

no certain judgment could be formed of the event : those often escaping favourably in whom the febrile symptoms rose highest the first night, whilst others, where the attack seemed slight, suffered a tedious illness, or perished. But this is to be understood of febrile symptoms ; for the more formidable pestilential symptoms seldom or never, in this class, came on until a more advanced stage.

“The buboes and carbuncles commonly made their appearance the first day ; but it was not unusual to see a successive eruption of these tumours in the course of the disease, as will be explained more fully hereafter.

“The remission on the morning of the second day was generally less obscure than in the other classes, even although no diaphoresis had preceded. The pulse was lower but not small ; the external heat temperate. The sick complained of head-ach, of pain from the tumours, and some were harassed by the vomiting ; but for the most part the vomiting, where it accompanied the access, ceased the first night.

“As the day advanced, the sick became more unquiet, changing variously at short intervals. Sometimes in the forenoon, a more regular exacerbation came on, without any preceding sense of cold. The pulse rose, the head grew more confused, and some showed a slight tendency to coma. The external heat was temperate, the tongue moist, and yet they complained of thirst : at other times, sensation in all other respects unimpaired, they had no desire to drink, though the pulse, the dry tongue, and heat of the skin denoted a higher degree of the fever.

“This exacerbation usually declined with a partial sweat, but notwithstanding the mitigation of the fever, the patient, in appearance, was more disordered; he complained of oppression at the heart, and illness which he could not describe. As night approached, he grew gradually worse. The feverish heat was more intense; the pulse less full, but very quick; the inquietude increased, the eyes became muddy, and he was much disposed to talk incoherently, or to slumber. A sweat breaking out early in the morning, brought on a mitigation of all these symptoms, in proportion as it happened to be more or less profuse; and even without a sweat some degree of mitigation usually was observed.

“The morning sweat on the third day, in some cases proved completely critical; but more commonly produced only a remission so favourable as to encourage the expectation of a more perfect crisis on the fifth; but where the patient neither sweated on the third, nor a sensible remission took place on that day, danger, in some degree, was always to be apprehended.

“It should be remarked, that, in the remissions here alluded to, the pulse not only became slower, but softer and fuller, especially after the sweat; and though the eyes still remained muddy, the anxiety and inquietude had abated, the intellectual faculties were clearer, and the patient found himself every way better.

“The exacerbations in the course of the third day, though not protracted, were pretty severe; and the third night was again disturbed by the recurrence of the same symptoms. But the pulse, though variable, remained in general more full and stronger than du-



ring the exacerbations of the second and third class, at the same period ; where the pulse, when it once sunk, however it might vary in quickness, seldom or never rose to the same standard as before.

“The remission on the morning of the fourth day, was sometimes preceded by a sweat, on which the length or shortness of its duration seemed to depend : but the sweat was never so profuse as that of the third or the fifth. The exacerbations which followed were nearly the same as the day before ; but the nocturnal exacerbation was commonly more severe, and continued till such time as a profuse sweat broke out, which was of various duration, and left the patient extremely faint and languid, but in every other respect manifestly relieved.

“After the sweat on the fifth, the subsequent exacerbations became slighter and slighter, and the buboes for the most part advancing favourably, little or no fever was left remaining after the beginning of the second week ; except perhaps symptomatic heats occasioned by the eruptions. But where the sweat on the fifth proved imperfectly critical, milder exacerbations, which usually declined in gentle sweats, continued to recur till the seventh day, when a second profuse sweat placed the patient beyond all danger.

“The syndrome of symptoms described as acceding the second day, sometimes kept back to the third or fourth ; in which case a critical sweat was not to be expected sooner than the fifth, or rather the seventh. The accession of these symptoms, sometimes retarded even later than the fourth, but then the future course of the disease became more irregularly various. The

exacerbations declined sometimes with, sometimes without sweats, and the patient passed slowly through the fever, without any sensible critical evacuation whatever.

“It may be remarked, however, that the buboes for the most part in this class, came to maturation ; but generally the fever had disappeared long before ; and in cases where these tumours had dispersed, there was very little difference observed in the course of the fever, if the patient had sweated, or in the quickness of recovery ; but where no critical sweat happened, recovery was slower. As to any particular tendency to relapse, where the buboes had dispersed, I met with no instances in favour of such an opinion.

“From the tardy accession of formidable symptoms, it sometimes happened that those who for some days seemed to be slightly infected or going on prosperously, came to suffer a tedious illness, or died, contrary to expectation ; while more alarming attacks terminated happily. In the latter case, the event remained doubtful to the *fifth* day ; in the former, till the end of the week (*seventh day*). At those periods a conjecture might be ventured with tolerable success ; though cases also occurred wherein matters remained in suspense several days longer.

“Hemorrhage, looseness, petechiæ, loss of speech, &c. and pregnancy, were circumstances, as in the former classes, that enhanced the danger ; but in this class exceptions were met with to the general rule.

“There is an instance of a pregnant woman dying the *third* ; but, in general, *the seventh* was the fatal day ; some, very rarely, struggled to *the eleventh*.

“The disease, under the forms arranged under the fourth class, begun to be prevalent before the plague had reached its height, and continued through its decline till its final cessation. It appeared to me, that more than one half of the infected of this class recovered.”

897. Class fifth. “To this class are referred cases of slight infection, wherein the more formidable pestilential symptoms never concurred, and all the infected recovered.

“The access here was often attended with so little apparent disorder, that the eruptions gave the first alarm ; and the fever, which came on afterwards, was frequently so slight as not to confine the sick to the house : others found themselves indisposed for two or three days, but were not sensible of any febrile heat whatever.

“But in this class the disease did not always invade insensibly. The febrile symptoms, especially the first three days, sometimes run pretty high ; and the fever afterwards, in nocturnal exacerbations particularly, run out to the end of the week, or longer : but as there was no concurrence of alarming symptoms, and the exacerbations, terminating for the most part in sweats, gradually diminished in force after the third or fourth night, it was not difficult in the worst cases to foretell the event at that period, nor necessary in others to defer a decision so long.

“All the infected had buboes or carbuncles, and very often both eruptions concurred in the same subject. Persons not confined by indisposition, were often by the inguinal buboes prevented from walking abroad.

The carbuncles constantly formed the black crust, and then suppurated; the buboes in one-third of the sick dispersed. The dispersion of the buboes was never observed to be attended with bad consequences, notwithstanding the general neglect of purging in the decline of the disease: indeed, very few of the infected had recourse to remedies, topical applications excepted, unless perhaps a bleeding at the beginning, where the febrile symptoms run high.

“This class was nearly as numerous as the fourth; but began to be predominant rather later, and reigned most of all in the decline of the plague in 1762.”

898. The sixth class, consisting of cases “dubious, anomalous, or extraordinary,” “admits of course of no general description.”

899. In the remarks on each symptom premised to the account of the several classes, Russel says, “The fever usually declined in the morning of the second day, and sometimes, but seldom, a slighter cold fit preceded the next exacerbation. It still more rarely happened, that the cold and hot fit returned regularly as in remittent fever, for several days successively: irregular coldness in the extremities was more common. Instances of the plague supervening in intermittent fevers were very rare.”

900. Of this last he mentions a case in which the patient had had a regular tertian for ten or twelve days; one of the exacerbations was not followed by the usual intermission, and the fever continued with irregular exacerbations, and an inguinal bubo was discovered on the second day of the continued or remittent fever.

901. "The pestilential fever, in its most continued state, rose and declined several times in the course of twenty-four hours, and the changes from better to worse, and vice versa, were more sudden and various than in other fevers. The exacerbations were irregular in the time of their return, in their violence and duration, and the intermediate calms or remissions were variously clear or obscure; but the mornings were generally calm, the nights disturbed."

902. A sense of oppression about the præcordia was in one degree or other a constant attendant, except in very slight cases. It was often accompanied by a pain in the scrobiculum cordis, of which the patients complained very much, and *in this case they could not bear to have that part touched.*

903. "This burning pain seemed to me to be seated about the orifice of the stomach, and I was once inclined to think it might be owing to bile or other acrid colluvies; but upon observing that very often, instead of being relieved, *it was rather increased by vomiting* which had procured free discharges, I suspected its continuance was to be imputed to a more fixed cause than matter contained in the cavity of the stomach."

904. Vomiting "was absent in a large proportion of the sick. Where it appeared at the beginning, and continued with short intervals, it generally denoted a fatal termination; and when it came on later in the disease, except in a slight degree, or was produced by extraneous causes, it was commonly in association with other dangerous symptoms.

905. "The matter ejected from the stomach was various. Where the reachings were strong and fre-



quently repeated, bile was sooner or later thrown up, but seemed to be emulged from the biliary ducts by the violence of the reaching; for at the beginning no bile was found in the basin, and draughts of warm water were returned untinged, or mixed only with the ordinary contents of the stomach.

“Sometimes indeed bile was thrown up at first, and must have been lodged in the stomach previously to the reaching; some cases were attended with this discharge, accompanied with a bitter taste in the mouth, a yellowness in the eyes, and other bilious symptoms; but, in general, bilious vomitings were not nearly so frequent as in the autumnal fevers. I do not recollect the having observed foetid discharges from the stomach; which probably was owing rather to accident, or to my inattention, than to such never happening; neither did I observe vomiting of blood; *but a blackish liquor sometimes came off the stomach in the last stage of the disease*, in the production of which, blood may, perhaps, have had some share.”

906. Costiveness was common and remarkable. Cathartics were not used. In the twelfth case it is stated that a suppository produced two small black stools very foetid. Three days afterwards the patient had three stools, consisting merely of black blood, without any mixture, or foetor. In other cases (xv. xvi. ciii.) dark, bilious, and black passages are mentioned.

907. An irregular eruption of the menses, as likewise an immoderate flux of them, was generally attended with danger. Women, in whatsoever stage of pregnancy, seldom escaped abortion; and many perished, even where the loss of blood had not been considera-

ble. Women near their time perished almost without exception, surviving delivery only a few hours. Some were delivered in the agonies of death.

908. Besides the symptoms above described, there were various eruptions; buboes, carbuncles, petechiæ, &c.

909. The inguinal bubo is a swelled gland, situated lower in the thigh, for the most part, than the ordinary venereal tumour, and near the crural vessels. It gradually enlarges, and at length protrudes the teguments into a visible circumscribed tumour, without outward inflammation. In some the tumour is exquisitely painful, in others obtusely so. Its progress to maturity is more or less rapid, sometimes advancing, and sometimes stationary, "alternately showing signs of ripening and dispersing," and sometimes actually disappearing. Some of these tumours acquire a schirrous hardness, and remain indolent and indurated for many months before they begin to disperse.

910. There are axillary buboes also; and the parotid glands, the cervical, and the maxillary glands, are all occasionally affected in the same way.

911. There are also painful glandular tumours, under the skin in every other part of the body: these Russel called spurious buboes; but the natives gave them the same name as the others.

912. Carbuncles are very inflammatory tubercles or pustules, of various appearances, which after a few days turn black; and when the patient lives long enough, the eschar is separated by the process of supuration around the edges, leaving an ulcer of various depth. They appear on every part of the body.

913. Common boils appear in a very few cases joined with pestilential tumours.

914. Petechiæ are spots of different sizes, shapes, and colours, appearing on various parts of the body. Some are small and round like flea bites, others are of an irregular figure; they are of various shades of red, and sometimes ash-coloured or livid.

A marble appearance of the skin is sometimes visible in different parts in the height of the disease, or some hours before death. The colours are pale, faint blue, and darkish red, more or less obscure, but never bright. It is not permanent until towards the end.

The skin, in various places, is sometimes deformed by narrow streaks of a reddish purple, or livid colour. When such appear on the face, they give a frightful appearance to the countenance.

The vibices or weals are much longer and broader, and resemble the marks left in fleshy parts by blows or stripes. They appear chiefly on the thighs, buttocks, and back, sometimes several hours before death, sometimes not until after.

Large blue or purple spots are sometimes observed, with or without the vibices, a little while before death, but most commonly not till afterwards.

Besides these various marks, the whole skin of the thighs, back and shoulders, often turns livid while the corpse is yet warm.

915. There is in the description of this epidemic, the most pointed and marked resemblance to our epidemic fevers, with the single exception that buboes and carbuncles are rare in the latter. It is difficult, and almost useless to particularize. Considered as a

description of our fevers, we assent to its truth and excellence, sentence by sentence. It has been read to several physicians, all of whom considered it as a description of the epidemic they had been familiar with, and as a very good one.<sup>1</sup> The shivering or sense of coldness in the access; the increase of the fever towards night, with full pulse, flushed face, and delirium or coma; the remission in the morning; the calm mornings and disturbed nights; the muddy red eyes; the oppression at the breast; the burning at the pit of the stomach, and the soreness on touching it; the vomiting, sometimes with and sometimes without discharges of bile, &c. from the stomach; the yellowness of the eyes, &c.; the cold clammy sweats; the hemorrhages; the discolourations of the skin, of various sizes and shapes, and more or less red or livid; the black vomit towards the last; and in females the disposition to menorrhagia, and to abortion, and the extreme danger to pregnant women in epidemics of very high grade; all these symptoms are familiar to practitioners of any experience in the epidemics of this country.

916. The only objection to the conclusion, that these epidemics of the Levant and ours are the same, arises out of the frequent occurrence of certain symptoms, supposed to be peculiar to the former, and to distinguish it from all other epidemic diseases. These are buboes, carbuncles, petechiæ, &c. The two former Russel says are equally diagnostics of true plague.

917. These, however, are neither essential nor im-

<sup>1</sup> Those few sentences in which buboes and carbuncles are mentioned were not read.



portant symptoms of the plague. In many cases they do not appear; and when present they have no influence over the course of the disease, or its final result, either in the bad cases or the slight. Moreover, those symptoms *which are important*, which Russel calls *the formidable symptoms* of plague; without which there is no danger, though half a dozen buboes and carbuncles be present; and the presence of which constitutes all the danger, though there be not one bubo or carbuncle present; these, viz. vomiting, delirium, and coma, are common to the plague, and to autumnal epidemics in general; at the same time that buboes, carbuncles, &c. occur in the latter also, although not so frequently as in the plague, or hot weather epidemic of the Levant.

918. In many cases of plague buboes and carbuncles do not appear at all. "The infected of the first class seldom or never had buboes, or carbuncles; and in a few of the second, where the disease proved quickly fatal, these eruptions were likewise absent." In some cases of the third class also, they did not appear. Carbuncles were observed "in about one-third of the infected only." "They very seldom, at Aleppo, were observed earlier than the month of May." By the third of May in 1762, 2188 persons had died. Russel says in terms, "That the plague, however, under a form of all others the most destructive, exists without its characteristic eruptions, or other external marks reckoned pestilential, can admit of no doubt," &c.

919. When they do appear, they do not influence the course of the disease, or the final result.

In the second class "none of the sick recovered."



“The course of the buboes was of no material consequence. They made their appearance commonly the second day, *oftener* the third, and sometimes later; a very small proportion were without eruptions. But the buboes never approached to maturation here, and their advancing or not, were circumstances which had no visible effect in hastening or retarding the termination of the disease.”<sup>1</sup>

In the fourth class, the buboes and carbuncles commonly made their appearance on the first day;<sup>2</sup> but a profuse sweat on the fifth or the seventh day, “placed the patient beyond all danger;”<sup>3</sup> and the fever disappeared long before the buboes came to maturation. “It may be remarked, however, that the buboes, for the most part in this class, came to maturation; but generally the fever had disappeared long before; and in cases where these tumours had dispersed, there was very little difference observed in the course of the fever, if the patient had sweated, or in the quickness of the recovery; but where no critical sweat happened, recovery was slower.”<sup>4</sup>

It is evident from this that the buboes, &c. had no influence over the progress or termination of the case, *the essential point was a profuse sweat on the fifth or seventh day*, which terminated the disease, while the buboes, &c. were still advancing.

920. Moreover, the buboes and carbuncles are of themselves of very little importance. When there was little or no fever, they were of so little consequence that they were scarce attended to in many cases;

<sup>1</sup> Russel's Treatise, p. 101.      <sup>2</sup> Ibid. p. 106.

<sup>3</sup> Ibid. p. 108.      <sup>4</sup> Ibid. p. 109.

whereas the formidable symptoms in the mortal cases were such as are common in our epidemics of high grade.

In the fifth class were included "cases of slight infection, wherein *the more formidable pestilential symptoms* never concurred," and all recovered.<sup>1</sup> At this place is a reference to thirteen cases in the appendix; all of which recovered, all had buboes, and five had carbuncles also. One (the 49th), had two carbuncles and a bubo. In this case, it is stated "the patient appeared to be in a fair way. *The carbuncles were spreading.*" Another (the 52d), had no less than eight carbuncles, or carbuncular pustules, and a bubo. Of this it is observed, "the number of eruptions is remarkable in this case, but *being unaccompanied by formidable symptoms*, they were less alarming."

Another (the 84th), had seven carbuncles and a bubo. The carbuncles were the first symptom in this case. The patient did not feel lassitude and head-ach till the third day. He walked every day upwards of two miles, to and fro, for medicine for his family till the sixth day; and it was not till the seventh that he had considerable fever. Dr. Russel observes, the carbuncles were unusually numerous; "*more formidable symptoms, as vomiting, delirium, coma, &c.* were absent." There were even many persons not confined by *indisposition*, but prevented by inguinal buboes from walking abroad.<sup>2</sup>

921. From this whole statement it is manifest that buboes and carbuncles are, in a great number of cases, not present; that when present they have no influence

<sup>1</sup> Russel's Treatise, p. 110.

<sup>2</sup> Ibid. p. 111.

over the progress or termination of the disease, either in the bad cases or the slight; the essential point being a profuse sweat on the fifth or seventh day, which terminates the disease, while the buboes are still advancing to maturation, and the carbuncles still spreading; that they are often present when there is no other indisposition; and therefore that they are unimportant local affections, not essential to the disease.

922. Buboes and carbuncles are moreover not peculiar to the plague. They frequently appear in our epidemics. I saw several buboes in the epidemic of 1804, and carbuncles in several years since. In 1824 I had a case of extreme violence, in the course of which appeared a very large swelling of the parotid gland, which suppurated; a carbuncle on the arm; and several tumours, such as Russel describes as spurious buboes, on the leg, head, shoulder, and arm; all on the right side. In the epidemic of 1826, I had a case in which a bubo appeared exactly in the spot mentioned by Russel, near the crural vessels, and suppurated. Glandular tumours, which disperse, are very common in our epidemics. Dr. Potter, speaking of the cases of yellow fever in Baltimore in 1798, says, "many of them were accompanied by inguinal buboes."<sup>1</sup> Dr. McCabe, of Leesburg, had a case of autumnal fever of very high grade, in which a large carbuncle appeared on the chin. Dr. Hildreth, in his account of the epidemic fever in Ohio in 1822, informs us, that it was "attended with symptoms of malignity, such as petechiæ, and glandular swellings, most commonly of the parotid glands."<sup>2</sup>

<sup>1</sup> Memoir on Contagion, Medical Recorder, No. 4, p. 561.

<sup>2</sup> Philadelphia Journal, &c. No. 17, p. 108.

923. The other pestilential eruptions, petechiæ, &c. have also a claim to be considered diagnostic symptoms of plague. The writers, at the time of the great plague in London, 1665, describe the tokens so as to "leave it without doubt (says Russel,) that some of them at least belonged to the class of petechiæ."<sup>1</sup>

924. From the account given above of these discolourations (914), it is evident that the red or livid petechiæ, the large blue or purple spots, the small streaks of a reddish purple, the red or purple vibices, weals, or stripes, and the livid appearance of the thighs, back, and shoulders, are of the same nature, differing only in shape and size.

Diemerbroeck, a practitioner in the plague often quoted by Russel, says, "Exanthemata pestilentialia (quæ vulgus mortis vel pestis maculas, Itali petechias, &c. appellant), sunt maculæ purpureæ vel rubræ, vel nigræ, aliusve coloris, ut plurimum rotundæ, aliquando oblongæ, latæ aliusve formæ in summa cute efflorescentes. Nonnulli distinguunt inter exanthemata et maculas, quod illa habeant eminentiam et sint de genere tumorum, hæc non. Verum nos, *omissa hac curiosa magis quam necessaria distinctione*, ad exemplum Fernelii utroque vocabulo indifferenter pro eadem re utimur."<sup>2</sup>

<sup>1</sup> Russel's Treatise, p. 133, note.

<sup>2</sup> Ibid. p. 132, note. Reference to Diemerbroeck, p. 72. The pestilential exanthemata (which the people call death-spots, or plague-spots; the Italians, petechiæ, &c.) are spots of a purple, or red, or black, or some other colour, for the most part of a round, sometimes of an oblong, of a broad, or some other form, efflorescing in the outer part of the skin. Some distinguish between exanthemata or eruptions, and spots, because the former may be prominent and of the nature of tumours, the latter not. But we, *omitting this more curious than necessary distinction*, after the example of Fernelius, use both words, indifferently, for the same thing.



All these discolourations, which, from this quotation, and others in Russel's notes, were considered by the old European writers, as plague tokens, or diagnostic symptoms of that disease, are by no means uncommon in our epidemics of high grade (653 to 655).

925. There is another important circumstance to be taken into consideration. There was, Russel states, an epidemic fever at the same time prevalent in the city.<sup>1</sup> He speaks of the cases of this epidemic as "malignant irregular tertians,"<sup>2</sup> which "in their beginning, a good deal resembled the plague;"<sup>3</sup> and "being attended by violent vomiting, and other formidable symptoms, was sometimes mistaken for the plague."<sup>4</sup>

926. Both these epidemics therefore observed the tertian type; both were accompanied by delirium and coma; by confused countenance and muddy eyes; by excessive anxiety and oppression at the præcordia; by nausea and vomiting, in some cases of bile, sometimes green; in others; by vomiting without any discharge from the stomach, and towards the last by the black vomit; by burning pain in the pit of the stomach; by dark, black, or common bilious passages; and by discharges from the bowels of pure black blood without griping.

927. These are all stated to be symptoms of the plague, and we know they are symptoms of autumnal epidemics of high grade: Russel admits this in admitting the difficulty of distinguishing the plague from the common epidemic: he says practitioners were sometimes a good deal perplexed to distinguish

<sup>1</sup> Russel's Treatise, appendix, p. xxx.

<sup>2</sup> Ibid. p. 40. 57.

<sup>3</sup> Ibid. p. 41.

<sup>4</sup> Ibid. p. 58.



them,<sup>1</sup> and speaks of disputes respecting the nature of particular cases.<sup>2</sup>

928. The only distinction then between the two epidemics, is the occurrence of buboes and carbuncles in the plague, and not in the ordinary tertians; these, according to Russel, being the diagnostic symptoms of the former. He himself, however, states cases which he calls plague, in which these did not appear; as well as a case in which a bubo appeared on the eleventh or thirteenth day of "a regular tertian."<sup>3</sup>

That the latter was a frequent occurrence will appear from the following considerations. Russel's work abounds with evidence of a general desire in patients to conceal eruptions, for fear of being deserted by their attendants on the discovery. Many buboes were unaccompanied by any general indisposition, many dispersed; in cases considered as common tertians they were not expected, and no search was made. It is evident therefore that many were able to conceal their buboes; and those cases in which this was done, passed for cases of the common epidemic.

929. It appears then, that at that time an epidemic prevailed in Aleppo, some of the cases of which were accompanied by a local affection, which frequently occurred without any febrile affection, and was in itself unimportant, and when occurring in cases of the epidemic, had no influence over the progress or termination of the disease, and therefore did not constitute any essential difference between those cases in which it appeared, and those in which it did not. They are therefore one epidemic, and consequently the plague is a miasmatic disease.

<sup>1</sup> Case xxiv.

<sup>2</sup> Case xv.

<sup>3</sup> Cases xxiii. xxiv. and xlii.

930. The identity of the two epidemics is strongly indicated by a circumstance mentioned by Russel. The plague was rapidly declining in July, the number of burials had decreased from 998 in a week, in the beginning of the month, to 232 in a week, in the end of it. During this decline, tertians, Russel says, began to be frequent; "as also another fever, which was represented to me as being of the malignant kind, distinct from the plague; but which, on visiting the sick upon my coming out of confinement, I found to be one of the irregular species allied to the tertian tribe."<sup>1</sup> "In August, when the plague was about ceasing, this fever had not only spread, but was become more fatal; and being attended by violent vomiting and other formidable symptoms, was sometimes mistaken for the plague."<sup>2</sup>

931. It is not however to be believed, that, as the circumstances became every day less and less favourable, through deficiency of moisture (887), to the production of miasmata and miasmatic fevers, that the latter would become more and more severe: and the statement above made carries on the face of it the conviction, that as *the epidemic* declined, and the eruptions became less and less frequent, those cases, which from the malignity of the symptoms were in the forepart of the season classed as cases of the plague (928), were now considered as cases of malignant tertians. But as the malignant symptoms were common to both, and there was nothing *in them* on which a certain decision could rest, different opinions were entertained respecting the nature of particular cases; as often occurs in our epidemics, some contending a case

<sup>1</sup> Russel's Treatise, p. 57.

<sup>2</sup> Ibid. p. 58.

is yellow fever ; others, that it is a common tertian of high grade.

932. The same doubts precisely occurred in London in 1665. The summer of that year was uncommonly dry and hot. This dry weather must have been early in the year, as hay was very scarce.<sup>1</sup> Sydenham describes the fever that appeared in the following terms, comparing it with the fevers of the preceding summers. "The pain in the head here was more violent ; the vomitings more copious ; and the looseness, which was generally prevented in the former fevers by a vomit, was increased thereby in the present fever, and yet the vomiting continued ; the external parts were dry," &c. "These were the diagnostic signs of this disease at its rise ; but towards the middle of the year the plague appeared, accompanied with several of its peculiar symptoms ; as carbuncles, buboes,"<sup>2</sup> &c.

933. This fever was "very epidemic" about the end of May and beginning of June. "From this time forwards that dreadful plague began to rage," &c. "Whether this fever under consideration deserves to be entitled a plague, I dare not positively affirm ; but this I know by experience, that all who were then seized with the true plague, attended with all its peculiar concomitants, and for some time afterwards, in my neighbourhood, had the same train of symptoms, both in the beginning and through the course of the disease." He left the city, but soon returning, says, "not long afterwards I attended several persons in fevers, which, to my great surprise, I found were of the same

<sup>1</sup> Bancroft on Fevers, p. 404, note.

<sup>2</sup> Sydenham' Works, Sec. II. Chap. I. 1. 2.

kind and nature as those I had so successfully treated before my departure ;”<sup>1</sup> &c.

It is apparent from this account, that a very violent and mortal fever was epidemic in 1665, of which some cases were attended with buboes, parotides, and carbuncles, and some were not; and that this was the only difference that Sydenham could discover between the different cases; whence arose his doubts.

934. Morton positively attributes the plague to the same cause which produced the autumnal fevers. He says a continued fever prevailed in 1658 throughout all England, particularly in the autumnal months: it arrived at its height about the beginning of September. It was at first a synocha, but, as the powers of nature gave out, turned to a synochus, with delirium, spasms, and other symptoms of high malignity. He was sick himself, and after a narrow escape, was three months recovering slowly; the continued fever with which he was first affected, turning to a quotidian, and then to a tertian intermittent. These synochas did not entirely cease during frost, and appeared sporadically during the following spring and summer, until the month of August, from which time through the whole course of the autumnal months, they on all sides increased, and became epidemic again. “And thus I observed this fever to be very general under the forms of a simple and proper synocha, and under a quotidian and tertian type, and during the fall to be more or less epidemic, until the year 1664.” The autumn of this year was very healthy; and almost all acute diseases had suddenly vanished.<sup>2</sup>

<sup>1</sup> Sydenham's Works, Sec. II. Chap. I. 35. 36.

<sup>2</sup> Medical Repository, Vol. 1, p. 51. 52.



935. There can be no question that this, so far, was the common autumnal fever of England, under the different forms of continued or remittent fever, quotidian, tertian, and quartan intermittents; and that the absence of them in 1664, a wet, and therefore, in that climate, a cool fall, was consistent with the origin of such fevers in miasmata.

936. But on the return of spring, 1665, (the weather being very hot and dry,) "*the poison gathering fresh strength*, and increasing prodigiously, unexpectedly *changed this synocha* to a most dreadful and destructive plague." "Yet, during the rage of the plague, vestiges of the synocha were not wanting; for as many as escaped from the plague, either by the efforts of nature or the aid of art, and began to exhibit buboes, parotides, and carbuncles, or other monuments and trophies of victory over the enemy, experienced in themselves, as if by a milder operation of the poison, or greater vigour of spirits, every day, or every other day, exacerbations and remissions of these symptoms, alternating with each other at stated hours."<sup>1</sup>

937, "Moreover, this dismal plague, disappearing about the beginning of the year 1666, the synocha fever, *occasioned by a milder poison*, began to show itself, attended with painful and dysenteric flux."<sup>2</sup> "As the genuine synocha, from the year 1665, (when, *from the working up of the poison to its height*, the plague broke out,) disappeared for almost two years,"<sup>3</sup> &c. "These synochas, when not seasonably and properly treated, often, *from an increase of the poison*, degenerated into malignant and fatal fevers; and even

<sup>1</sup> Medical Repository, Vol. 1, p. 52.    <sup>2</sup> Ibid. p. 53.    <sup>3</sup> Ibid. p. 55.



sometimes, *by reason of an unusually deleterious degree of the poison*, indicated malignancy from the beginning, being of the *purple or petechial* kind, and distinguished by a morbillous eruption, watery blisters scattered over the neck and breast, parotides, buboes, carbuncles, and other malignant symptoms.”<sup>1</sup>

938. It is plain from these extracts that Morton attributed all these to the same cause, which he calls a poison.

It is also evident that when the autumnal fevers of England, at that period, were of a high grade, cases of the plague occasionally appeared; just as when our autumnal fevers are of high grade, a few cases of the yellow fever appear (404. 409).

939. It has been shown that the plague arises in situations and circumstances in which miasmata abound; that it increases and decreases as the circumstances of heat and moisture are more or less favourable to the production of miasmata; and ceases when through the coldness of the weather or extreme dryness, they cease to be produced (856. 870. 891); and that the effects observed in these circumstances, viz. the symptoms of the plague, are the same with those observed in fevers acknowledged to be miasmatic; there being no essential difference between them; those symptoms which have been considered as diagnostic signs of plague not being important, essential, or peculiar to that disease (892 to 938): Whence it is evident that the plague is a miasmatic disease.

<sup>1</sup> Medical Repository, Vol. 1, p. 56.

## CHAPTER XII.

### ORIGIN OF TYPHUS FEVER.

940. Typhus fever is also produced by miasmata.

In support of this it will be shown, that this disease arises in situations in which miasmata abound, and in which, in all parts of the earth, miasmatic fevers are produced ; that in the time of its rise and fall, its greatest height and lowest declension, it corresponds with miasmatic fevers, and that the same kind of weather is most favourable to the increase of both ; that typhus fever on board of ships at sea, or in port, arises in circumstances in which miasmata abound ; that the symptoms of typhus fever are the same with those produced by miasmata ; that typhus fever appears in connexion with miasmatic diseases ; and that they are mutually convertible into one another.

941. Typhus fever arises in situations in which miasmata abound.

Dr. Currie, in his Medical Reports, states, that “the corporation of Liverpool, being about to apply to Parliament for powers to improve the streets and the police of the town, requested the physicians of the Infirmary and Dispensary to suggest to them such alterations as might contribute to the health and comfort of the inhabitants.”<sup>1</sup> “The physicians took this request into serious consideration, and presented a re-

<sup>1</sup> Currie's Medical Reports, p. 246.

port of considerable extent, including a view of *the causes* of the uncommon sickness of the two preceding years, and of *the measures requisite to prevent its recurrence*, and to remove the frequency of contagion in the habitations of the poor." Among a number of recommendations, they pointed out the necessity of *enforcing cleanliness in the streets*, advised a general review of the common sewers, and that effectual provision should be made for *draining the grounds within the liberties*. "Repeated remonstrances" (the words of the report) "have been made for *the last twenty years*, on the collections of *standing water, including filth of every kind*, which are suffered to remain in the district which extends along the termination of the streets from St. Paul's square to Byron-street, and to which *the low fevers*, which, *in the autumnal months especially*, infest these streets, are principally to be imputed."<sup>1</sup>

942. These fevers, so manifestly, from the season and situation, produced by miasmata, are called typhus by Dr. Currie, not only in the general declaration that typhus is the common fever of England,<sup>2</sup> the prevailing fever of that island and of Europe, the epidemic of all the great towns, jails, hospitals, and manufactories;<sup>3</sup> but in this particular instance. In order to convey an idea of the prevailing diseases of Liverpool, he gives a list of the diseases of September 1790, extracted from the register of the dispensary,<sup>4</sup> kept by the apothecary of that institution, of whose character he speaks in the highest terms. The number 310 is

<sup>1</sup> Currie's Medical Reports, p. 247.

<sup>2</sup> Ibid. p. 27.

<sup>3</sup> Ibid. p. 48.

<sup>4</sup> Ibid. p. 232.

marked opposite to the word fever; but that typhus fever is meant, appears from the same number being stated for the same month, in the general table of the number of cases of *typhus fever* for every month for seventeen years.<sup>1</sup> There is no mention of autumnal fever in this list for September 1790, nor of any other febrile disease, excepting only the inflammatory diseases usual in that climate, as catarrh, pneumonia, rheumatism, &c. It is evident from this statement, not only that typhus fever arises where miasmata abound, but that the miasmatic fevers, which must have arisen in such a situation and at such a time (941), were called typhus.

943. In the same work Dr. Currie makes the following statement.<sup>2</sup> “The 30th regiment, as is usual with troops in Liverpool, was billeted in the town, but paraded and mounted guard in the fort situated north of the town, on the banks of the river. The general guard-room had been used previous to the arrival of the 30th, as a place of confinement for deserters; it was extremely close and dirty, and under it was a cellar, which in the winter had been full of water. This water was now half evaporated, and from the surface issued offensive exhalations.” In a dark, narrow, and unventilated cell, of this guard-room, it was usual to confine such men as misbehaved. “The typhus or jail fever made its appearance in two of these men about the first of June, and spread with great rapidity.”

944. A temporary hospital was fitted up, and great exertions were made to arrest the progress of the fe-

<sup>1</sup> Currie's Medical Reports, p. 236. See 951.    <sup>2</sup> Ibid. p. 23.

ver by washing, ventilation, &c. but in vain. "The weather was at this time wet and extremely cold for the season; the men on guard could not be prevailed on to remain in the open air; and from passing the night in the infected guard-room, several of the privates of the successive reliefs caught the infection and fell ill on the 10th, 11th, and 12th of the month."<sup>1</sup>

Compare this statement with that made by Dr. Potter, respecting the production of yellow fever in a house near Baltimore in the same way precisely, viz. by exhalations from water in the cellar (736). The presence of miasmata in abundance are in this case at Liverpool unquestionable.

945. Dr. Currie also mentions a typhus fever which commenced in May 1800, in the Cheshire regiment, in barracks at Gosport, a town on the west side of the harbour of Portsmouth, in the south of England (523). In two months thirty of the men were seized. Towards the end of July, finding none of the usual means successful in arresting the progress of the fever, the surgeon of the regiment, Mr. Marshall, had recourse to the affusion of cold water. By this means the patients rapidly recovered, so that the hospital was thinned; but many new cases occurred in *August* and *September*, and in November the fever ceased.<sup>2</sup>

946. Dr. Ferriar, by the facts stated in his *Medical Histories*, throws considerable light on the subject of the origin of typhus fever. He says the fever generally prevalent in Manchester, and the surrounding country, is a mild typhus.

Manchester is situated between two rivers. Some

<sup>1</sup> Currie's Medical Reports, p. 25. <sup>2</sup> Ibid. p. 310.



of the streets, when he wrote the above work, were not drained. "In some parts of the town, the cellars are so damp as to be unfit for habitations." The other habitations of the poor are wretchedly filthy and confined. Situated in alleys closed at one end, with few windows, and those often with fixed sash, so as not to open, ventilation is almost impossible; and the miasmata that are abundantly supplied by the moisture and filth of the streets, remain long undispersed.

947. He says, "During the late epidemic *it was observed* that the fever prevailed most in streets which were *not drained*, or in which dunghills were suffered to accumulate, or where the blood and garbage from slaughter houses were allowed to stagnate."<sup>1</sup>

948. We have here (941 to 947) direct evidence that the typhus fever arises in situations in which miasmata abound. More of the same will be mentioned incidentally in the course of the discussion.

949. We shall now show that in the time of its rise and fall, its greatest height and lowest declension, typhus fever corresponds with the miasmatic fevers of other countries.

We know that the reverse of this is confidently asserted; that typhus fever is considered as a disease of cold weather peculiarly; and that it disappears in hot weather. There is, however, on this point, as well as on the whole subject of typhus fever, a strange inattention to *facts*.

950. We shall show from the best authority, from facts stated by those very persons who maintain this doctrine, that typhus fever is not peculiarly a dis

<sup>1</sup> Ferriar's Medical Histories, p. 225. 226.

ease of cold weather ; that like all miasmatic fevers in temperate climates, it increases as the autumn advances ; is at the highest in that season of the year, and declines on the coming of cold weather ; and that it is particularly malignant or severe in the hottest weather.

951. We shall, in support of these points, give the following statement of the number of cases of typhus fever admitted into the Liverpool Dispensary in every month, from the first of January 1780, to the last of December 1796. It is taken from Currie's table ;<sup>1</sup> but the last column, giving the total number in each year, is omitted, as unnecessary to the elucidation of the point in hand. His table was formed from a register kept by the apothecary of that institution, Mr. Avison, of whom Dr. Currie speaks in the highest terms.

<sup>1</sup> Currie's Medical Reports, p. 235. 236.

## THE TABLE.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1780	150	125	179	173	168	183	191	150	129	186	150	133
1781	130	146	180	200	187	154	157	127	167	234	208	223
1782	268	265	231	292	148	159	120	140	143	182	150	158
1783	210	158	184	207	222	212	286	227	265	316	257	273
1784	170	194	245	247	232	225	270	230	266	247	369	297
1785	285	268	296	294	219	187	173	180	186	250	244	182
1786	191	166	216	244	202	155	159	188	169	211	167	197
1787	259	209	301	234	313	356	255	192	218	234	283	326
1788	236	174	213	255	253	245	271	311	258	341	315	295
1789	319	176	338	323	391	205	184	162	212	214	204	208
1790	176	248	337	294	281	247	343	270	310	340	355	269
1791	253	247	277	230	233	240	266	248	300	344	335	371
1792	359	361	269	278	261	237	236	223	211	330	212	174
1793	174	209	221	259	237	334	199	197	338	305	224	228
1794	157	230	383	280	337	305	291	245	303	290	258	326
1795	152	265	546	204	234	230	248	159	196	239	317	180
1796	197	161	266	242	288	176	203	182	254	329	153	247
Total.	3683	3602	4682	4256	4206	3850	3852	3431	3925	4592	4201	4087

952. That typhus fever is not peculiarly a disease of cold weather, will appear from a very slight inspection of this table. Under the name of each month, is given the whole number of the cases of typhus which occurred in that month for seventeen years. Of these sums total, the smallest in the table, except one, is under February, and the next under January; and the whole number for the three winter months, December, January, and February, for seventeen years, viz. 11,372, exceeds that of the three summer months, June, July, and August, viz. 11,133, only by 239 cases; an average of only four or five to the month.

In looking through individual months, it will be observed that the *smallest monthly number* of cases, in any one of the seventeen years, occurred, notwithstanding the severe winter epidemics which greatly increased the number of cases in the winter months, nine times in December, January, and February; and only six times in June, July, and August. In four of these six also, the winter and summer months were almost even; in 1781, January exceeding August only three cases; in 1785, December exceeding July only nine cases; in 1786, February exceeding June only eleven cases; and in 1789, February exceeding August fourteen cases. On the other hand, the highest number occurred in December only once; in February, once; and in June and July each once.

953. Typhus, like all miasmatic fevers in temperate climates, increases as the autumn advances, is at the highest in that season of the year, and declines on the approach of cold weather; and, like them, is particularly severe or malignant in the hottest weather.

The lowest number of cases in the above table is under August ; it increases from 3431 in that month, to 3925 in September, and to 4592 in October ; and declines in November to 4201, and to 4087 in December.

This agrees with the increase and decrease of our autumnal epidemics. The only difference in the time is, that the autumnal epidemic of England, typhus, commences a little later, and continues somewhat later in the year than ours. Thus, ours commences in August, so that there is a perceptible increase of sickness in that month. In England it does not begin till the month after. Ours is at the height generally in September, sometimes in October, as in Philadelphia in 1793 : in England it is at the height generally in October, sometimes in November, as in 1784, 1790, and 1795, in Liverpool.

In some of the years, as in 1780, 1782, and 1783, this autumnal increase is small in comparison with what it is in others ; but though sometimes small, it is *invariable*, and the *uniformity* shows the operation of an uniform cause ; as the occurrence of bad colds only, in some winters, shows a minor degree of the operation of the same cause, which sometimes produces pleurisies ; or as the occurrence of a few bilious cases shows a minor degree of the operation of the same cause, which in some years produces an epidemic.

954. There are many instances mentioned by Trotter and Currie of an epidemic typhus commencing in warm weather, increasing through the autumn, and declining on the approach of cold weather. Currie, speaking of the sickness in Liverpool in the fall of



1801, says, the dysentery appeared in July; the scarlatina anginosa soon afterwards, which spread widely in August; and lastly, the typhus fever burst its usual boundaries, the habitations of the poor, and occasioned general alarm. "In the months of August, September, October, and the greater part of November, 1801, the degree of sickness in Liverpool was unexampled in the history of the town." "In the months of August, September, and October, there were upwards of fifteen hundred deaths in Liverpool, making an excess of nine hundred above the usual number. In *September* alone, the deaths amounted to six hundred and ten."<sup>1</sup>

955. The physicians of Liverpool, in their report to the corporation, allege the necessity of draining certain streets, because to them, "the low fevers, which *in the autumnal months especially* infest these streets, are principally to be imputed" (941).

956. Dr. Ferriar, speaking of the health of Manchester, says, "In the summer and autumn of 1794, the usual epidemic fever (a mild typhus 946) became very prevalent among the poor in some quarters of the town, particularly after a *bilious colic* had raged among all ranks of people. To the ordinary causes of fever were now added the influence of a *burning summer*, succeeded by *very wet but yet warm weather*."<sup>2</sup>

Miasmata here certainly abounded, and there can be no doubt that in any other country this would have been called an autumnal or miasmatic fever.

957. Dr. Currie gives us a particular account of an

<sup>1</sup> Currie's Medical Reports, p. 262.

<sup>2</sup> Ferriar's Medical Histories, p. 231.

epidemic at Canterbury, from a letter to him from the surgeon of a regiment of horse-guards (the Blues) stationed there.

“A short account of the regiment previous to the breaking out of the fever will be necessary ; as it will be seen that the modification of typhus which took place was peculiar.

“The Blues went to Canterbury, in October 1803, in the healthy state which that old corps generally enjoys. In the months of November, December, and January following, a good many cases of fever had appeared, and several died of it ; and I have been informed by my very intelligent assistant, Mr. Peach, that it was from that combination of typhus and pneumonia, which has been denominated *pneumonia typhoides*.”<sup>1</sup>

958. The epidemic commenced on the 28th of July 1804. A patient was brought to the hospital, and died on the 30th. On the 11th of August another formidable case of typhus appeared ; the patient died on the 14th. Six other cases speedily followed. “In September our situation became alarming in the extreme ; nearly a fifth of the regiment were on the sick list. In particular, there were thirty-three cases of fever, and six of dysentery.” In consequence of this state of things, the regiment was encamped on the fifth of September. After the middle of this month the disease declined, and the last case occurred on the 21st of October. The decline of the disease is attributed to the whole regiment bathing every day after the 12th of September ; but it is plain, that, in leaving the town,

<sup>1</sup> Currie's Medical Reports, p. 393.

they removed from the cause existing there, which at the same time was producing among the inhabitants of Canterbury the same disease.

959. This town is situated in a rich valley on the banks of the river Stour, which, in that part of its course, separates into several branches, forming five or six islands. This situation is calculated to produce miasmata in hot weather, and would lead us to expect an epidemic such as occurred.

960. It is to be observed that it commenced at the time when epidemics from miasmata usually commence, was at its greatest height in that month (September) in which they usually are, and declined and terminated when they usually decline and terminate. The summer of 1804 was very hot in Europe.

961. It is further to be observed that this fever was accompanied by dysentery, the cases of which were very numerous; there having been sixty cases of fever in the regiment, in the whole time, from the 28th of July to the 21st of October; whereas there were twenty cases of dysentery from about the 12th of September.

962. It is evident, therefore, from the *situation* of the town, from the *time* of the rise, the height, the decline, and termination of this epidemic, and from the number of cases of dysentery accompanying it, that miasmata in abundance were present.

963. After the great naval engagement of the first of June, 1794, between the English and French fleets, the French prisoners were landed, and confined in the neighbourhood of Portsmouth and Plymouth. They were in a very sickly state when they landed, having been confined for the whole time that they were at sea in ships remarkably dirty, and ill ventilated.

964. The situation of the two ports above mentioned is such that they must abound in miasmata in the proper season. The situation of Portsmouth, on the low island of Portsea, has been already noticed (523), and the prevalence there, in the hot summer of 1764, of a miasmatic fever of high grade. Plymouth is, next to Portsmouth, the most considerable harbour for ships of war in England. It is situated at the mouth of two rivers.

965. In this situation of things, in the hot summer of 1794 (956), there was a vast mortality among these prisoners; nor was it confined to them: "the Middlesex militia who did the duty of guard over them were affected, some of whom died."<sup>1</sup> "I have been told that 338 Frenchmen died at Forton alone in less than four months."<sup>1</sup>

966. These prisoners were landed about the middle of June, and these four months therefore extended through that time precisely in which miasmata abound, wherever there are sufficient sources of them in hot weather. The abundance of marshy grounds, filth, &c. about these seaports is unquestionable. The weather was unusually hot. In June the thermometer stood at 80 degrees towards the end of the month, in the shade.<sup>2</sup> "In the beginning of July the weather continued sultry to an uncommon degree."<sup>3</sup> August also was uncommonly warm in England.<sup>4</sup> "The weather during the months of October and November was mild as to temperature, but thick and hazy, with much rain, and hard gales of wind from the south-

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 84.    <sup>2</sup> *Ibid.* p. 78.

<sup>3</sup> *Ibid.* p. 79.

<sup>4</sup> *Ibid.* p. 89 and 197 compared.

west.”<sup>1</sup> This weather was calculated, in every respect, to put an end to a miasmatic fever.

967. We have seen that autumnal epidemics are frequently followed by winter fevers, the effect of the joint operation of miasmata and cold (597, &c.). Typhus fever is also followed by winter fevers, in which the symptoms are “a combination of typhus and pneumonia” (957).

In autumnal epidemics the number of the sick, after declining as the temperature of the season declines, increases again as it becomes very cold. In mid-winter or the settled cold weather, the sickness again declines; but, in the breaking up of the winter, during the cold wet weather, it increases again.

In this part of the world, the decline of the autumnal fever is in October and November. The commencement of the winter epidemic is in December or January. January and February, or the latter part of the former and forepart of the latter, is the time of its declension; and the last of February and March, the time of its renewal. It declines again as the weather settles, and sometimes in the hot, dry month of June, there is scarce a case in the country.

The same occurs in other parts of the earth. In Minorca the same was observed by Cleghorn, who gives a very full account of the “winter fevers” of that island<sup>2</sup> (641. 642). So also, in the autumnal or miasmatic fever, the plague of Aleppo, the same occurred. Russel says, “About the middle of November it seemed to me to decrease; but from the beginning of the

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 104.

<sup>2</sup> Cleghorn’s *Observations on the Diseases of Minorca*, chap. vi.



fourth week, till the 20th of December, it certainly increased, particularly among the christians."<sup>1</sup> This is plainly shown by the weekly bills of mortality, from the second of November to the fourth of January.<sup>1</sup>

Nov. 1st week,	2d week,	3d week,	4th week.	Dec. 1st week,	2d week,	3d week,	4th week,	5th week.
Burials 137	116	124	167	166	156	166	105	99

The same also occurred in the plague in 1665 in London; as may be seen by reference to the table (888); and also in 1636.<sup>2</sup>

968. Precisely the same occurs also in the typhus fever. After the decline a winter epidemic often commences, in which the disease is a combination of the symptoms of typhus fever, with pneumonia or catarrh;<sup>3</sup> and all the changes common in miasmatic fevers, the table shows, occur in typhus. After the time of the greatest height in the autumnal season, there was, on the coming of cool weather, a decline in the number of cases in November or December in sixteen of the years. In one (1787) the decline did not occur till January.

In five years the decline continued without interruption till some time in mid-winter: but there was an increase in the number of cases in the winter of twelve years of the seventeen, viz. 1781, '82, '83, '85, '86, '88, '89, '91, '93, '94, '95, '96. This increase was at its height in December in six years: it continued till January in five years, viz. in the winters of 1781-2. '82-3. '85-6. '86-7. '88-9, and '95-6.

From the time of the greatest height in those twelve

<sup>1</sup> Russel's Treatise on the Plague, p. 41.

<sup>2</sup> Ibid. p. 276.

<sup>3</sup> Currie's Medical Reports, p. 393.

Trotter, *Medicina Nautica*, passim.

years, the number of cases declined till some time later in the winter. The lowest declension occurred in January five times ; in February five times ; in March once.

From the lowest declension in mid-winter there was, in every instance, an increase towards the breaking up of the winter, and in the unsettled weather of the spring. It commenced in February seven times ; in March nine times ; and in April once.

From this time there was a decrease before the autumnal season, but not so uniform as in winter ; because the occasional very hot weather in the summer months, as in June 1794, when the thermometer was at 80 degrees, produces an increase out of order ; extraordinary heat in a moist climate abounding with vegetation, always producing extraordinary sickness.

969. The connexion between the summer and winter epidemics, the consequence of the co-operation of cold with miasmata in producing the latter, is more apparent and striking, by attending to the correspondence between the number of cases in the commencement of cold weather and the breaking up of winter, with the number of those in the autumnal months immediately preceding. It will be seen on inspecting the table (951), that in every instance in which the number of cases in December, January, February, or March, was much greater than common, the number in the preceding autumnal season corresponded.

Thus, in the winter of 1781-2, the number of cases was considerably greater than in the preceding years ; and the number in the autumn of 1781 was greater than in the autumn of 1780. So also, a greater num-

ber than common in the autumn of 1788, (October), was followed by an unusual number in January 1789; an unusual number in the autumn of 1791, by an unusual number in the following winter generally; the same in September and October 1793, by the same in February and March 1794; and the same in the autumn of 1794, by the same in the following December, February, and March.

970. The variations in the different seasons, as exhibited above (table 951), would be more striking if the excess in the winter months, from winter epidemics, were thrown off. This is proper in order to place the subject in the clearest point of view. Thus, in this country there is no question but that the annual sickness is caused by miasmata, and the month of September is ordinarily the time of its height. But if we were to form an estimate of the comparative sickness of the different months from what occurred in the years from 1806 to 1817, we should greatly err. The autumnal seasons of those years were unusually healthy (327), and in one of the winters, 1814-15, occurred the most mortal epidemic ever known in this country. If then, we were to form an estimate of the comparative sickness of the different months from what occurred in those years, the excess of the month of September would be greatly reduced, and the proportion of the winter months increased. In order, therefore, to set the matter in the true light, we must throw off the excess from the winter months of 1814-15; as we propose to do with respect to the winter epidemics which occurred in the seventeen years mentioned in the table of typhus fever in Liverpool (951).

971. Winter epidemics occurred in eight years of the seventeen; viz. in 1781-2. 1784-5. 1786-7. 1787-8. 1788-9. 1790-1. 1791-2. 1794-5. A small increase of cases in the course of the winter occurred also in 1782. '83. '89. '93. and '95.

If we divide the number of cases in December of the other nine years, viz. 1783, by nine, we shall have the average number for that month, when there is no winter epidemic. If we multiply this average number by seventeen, we shall have the number of cases that would have occurred in December, according to the ordinary rate of decline of the autumnal epidemic, where no winter epidemic interfered to increase it, viz. 3368 cases.

In the same way we shall obtain for the month of January 2937 cases; for February 3094; for March 4176; for April 4053; and for May 4068.

The total numbers for the seventeen years (table 951), will then stand thus.

Jan.	Feb.	March,	April,	May,	June,	July,	Aug.	Sep.	Oct.	Nov.	Dec.
2937	3094	4176	4053	4068	3850	3852	3431	3925	4592	4201	3368

Or, to show the whole course of this epidemic more perfectly, its rise in the commencement of the autumnal season, its progress as that season advances, and its decline on the approach of cold weather, we will place the months in an order somewhat different; thus,

Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March,	April,	May,	June,	July,
3431	3925	4592	4201	3368	2937	3094	4176	4053	4068	3850	3852

972. These variations are strikingly shown by another view of the subject. The greatest monthly number of cases in the year occurred the following number of times in each month;

In Jan.	Feb.	Mar.	April,	May,	June,	July,	Aug.	Sep.	Oct.	Nov.	Dec
0	1	3	2	1	1	1	0	1	4	2	1

Or, arranging the months according to the *course of the epidemic*, it will stand thus ;

Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April,	May,	June,	July,
0	1	4	2	1	0	1	3	2	1	1	1

Here the preponderance in favour of the autumnal season is striking, as well as the influence of the cold wet weather of March.

973. These variations in the different seasons are in some years more remarkable than in others, as in the following instances.

	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1783	227	265	316	257	273	170	194	245
1789	162	212	214	204	208	176	248	337
1790	270	310	340	355	269	253	247	277
1794	245	303	290	258	326	152	265	546
1796	182	254	329	153	247			

974. The following are instances of autumnal epidemics, not followed by such an increase of the number of cases in winter, as to deserve the name of winter epidemics.

	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1784	230	266	247	369	297	285	268	296
1785	180	186	250	244	182	191	166	216
1792	223	211	330	212	174	174	209	221
1793	197	338	305	224	228	157	230	383
1795	159	196	239	317	180	197	161	266

975. The effect of hot weather on the number of cases of typhus was remarkably displayed in the year 1794. In June the temperature nearly equalled that of the tropics, the mercury in the thermometer being as high as 80 degrees in the shade (966) ; and the num-



ber of cases was somewhat higher than in any of the autumnal months. In the same year, the weather in October and November was mild in temperature, and there were hard gales of wind (966); and in those two months the disease declined.

976. The effect of cold weather following a season in which miasmata abound, is also shown by the contrast between the number of cases in the winters of 1794-5, and 1795-6. The summer of 1794 was uncommonly hot, and the winter and spring following were colder than had been experienced in England "in a long series of years."<sup>1</sup> The number of cases in December was unusually great, and in March there were very many more than occurred in any of the seventeen years of the table (951).

In September, October, and November, 1795, the number of cases was above the average for seventeen years, but the winter and spring following were the mildest experienced in England "in a long series of years;"<sup>1</sup> and the number of cases was considerably smaller.

	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
In the autumnal season, and } very cold winter of 1794, }	303	290	258	326	152	265	546
In the autumnal season, and } very mild winter of 1795, }	196	239	317	180	197	161	265

977. The very same effect produced, as above stated, in England in the very cold winter of 1794, was experienced from the same cause some years ago in this country. The winter and spring of 1814-15, will be long remembered in Virginia for the fatal fever which then prevailed. The winter was extremely

<sup>1</sup> Currie's Medical Reports, p. 234.

cold; the snow lying two feet deep on level ground, a very unusual thing.

978. Another particular may perhaps be worth mentioning. The variations in the time of the commencement and of the height of the epidemic typhus in England, are the same as they are in the miasmatic epidemics of this country. Sometimes one summer month and sometimes another is most healthy; and sometimes one and then another month of the autumn is most sickly. Thus, June with us is generally most healthy; but sometimes July is very healthy: September is generally most sickly, but sometimes October exceeds it; as in 1793 in Philadelphia (406).

In England, the table shows that although the number of cases in August is on an average the smallest, yet the minimum occurred in June seven times, in July twice, and in August eight times, in seventeen years.

The greatest number of cases, in the totals of the autumnal season, occurred in October; in the individual years, it occurred in September twice; in October eleven times; in November four times.

979. It is observable, that although the number of cases of typhus in England rises and falls in the different seasons precisely as our miasmatic fevers do, of which some remarkable instances are given above (954. 958), yet there is on the whole not so great a difference between the different months as there is with us.

This arises out of the difference between the climate of that country and of this, and the excessive crowding in the habitations of the poor of that country.

980. In this country the spring is usually wet. As

soon as warm weather comes, we have a few bilious remittents, and in May there is sometimes a considerable number of cases. June is however generally very dry, and the country is often parched, the grass appearing sometimes quite dead. At this time the country is very healthy. In the latter part of July and August we generally have a good deal of rain; sometimes very much. Soon after the wet weather sets in our epidemics commence, and are in proportion, for the most part, to the quantity of water that falls, as the heat of the climate is always considerable. If the rains fall earlier than usual, the sickness commences earlier (368).

It appears then that we have a sickly time whenever we have rain in hot weather; and this indeed would follow of course from what has been already established on that subject. Our exemption in June, therefore, is for want of rain in that month; and it is plain, that if we had continued wet weather throughout the summer as in England, we should have continued sickness as they have.

981. In England the surface of the country is rather flat, often marshy, fertile, and abounding with vegetation. The climate is very moist, the rains gentle and very frequent. In the towns, accumulations of filth, ponds of water, and undrained streets, are more common than with us; the evil consequence of these things not being so obvious in that temperate climate, they are permitted to exist to an extent, which, in this part of the world, would be followed by mortal epidemics (340. 375). The circumstances necessary to the production of miasmata exist therefore more uniformly

through the summer with them than with us, and the consequence is a greater uniformity in the number of the sick ; but the autumnal increase in England resembles ours in being much greater when the heat of the weather is unusually great. Thus, in Liverpool there were nine hundred deaths more than usual in the very hot summer of 1794.

982. In the winter the proportion of cases is somewhat greater in England, on account of the excessive crowding in the habitations of the poor. In epidemics universally admitted to be the effect of miasmata, the number of cases is much greater in confined places, as in the crowded houses of seafaring people about the wharves of cities, and in those of the poor in the alleys. In such places, for want of ventilation, the air, by repeatedly breathing it, becomes impure ; and the gas, which we have given some reason to believe is the cause of autumnal fevers (583), is produced in abundance. This is the only known human effluvia, generated by healthy bodies, capable of producing noxious effects, or dense enough to remain where it is generated ; and, whether the argument respecting the nature of miasmata be considered as conclusive or not, it is clear, that, on the grounds stated by Beddoes (596), the effect of miasmata must be increased by the confinement and consequent impurity of the air.

983. This is observed to be the case in this climate, where every effort is made to obtain a free circulation of air, and where even in winter, in many parts of the country, open doors are often seen.

In many places in England the confinement and

consequent impurity of the air is almost beyond belief. Dr. Ferriar, in his Medical Histories, mentions houses in blind alleys almost entirely excluded from light and air; also a range of cellars of four rooms, the two centre rooms being completely dark, and the fourth ill lighted, and ventilated chiefly through the others, and containing four or five beds each. From the accounts of Ferriar and Currie these almost incredible things are common (831).

If the effect of miasmata is increased by crowding, in hot countries where fresh air is necessary to immediate comfort, and where consequently it is eagerly and continually sought after, how much more must it be in these miserable abodes; particularly in winter, when want of fuel compels the poor to keep close.

984. The typhus fever on board of ships at sea or in port, arises in circumstances in which miasmata abound (940).

Typhus fever is very common on board the guard-ships, receiving-ships, and hospital-ships, stationed in the different harbours of England; and in ships at sea in northern regions.

The situation of the two principal harbours of England, Portsmouth and Plymouth, has been already mentioned (964).

Chatham, another principal station of the navy, is situated in the county of Kent, a considerable part of which is low flat land, with many marshes. The great Romney marsh, a vast tract of rich wet land, occupies the most southern part of this county.

Sheerness, not far from Chatham, is surrounded by



marshes: at this place there was an establishment of sick-quarters for sailors.<sup>1</sup>

Deal is also a seaport of Kent; off which is the ship-road called the Downs. The existence of miasmata there is evident, not only from the flatness and marshy state of that county, but from the complaint of Trotter of the agues that were carried on board the fleet from Deal hospital.<sup>2</sup>

There are a number of others of less importance, at or near the mouths of rivers, which in that flat part of the island are very marshy. The whole of them are precisely such places as those, which, in southern countries, abound with miasmata, and are the seat of miasmatic diseases.

985. The ships for receiving and guarding the impressed men, and the hulks, on board of which the crews of ships of war are confined during the time those vessels are under repair, are not only exposed to the action of miasmata arising from the abovementioned sources, but are themselves so filthy as to become sources of the same morbid gas. In the best disciplined ships, a great deal of filth is unavoidable, from the crowding together of such a number of men in a small compass. But in guard-ships, &c. often excessively crowded, the difficulty is vastly greater. Ships-companies are often two or three months in a hulk much smaller than the ship they came out of; "during this time, much of the etiquette of discipline is laid aside, because the present confined and nasty state of the hulk renders personal cleanliness impracticable,"<sup>3</sup> &c.

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 312.

<sup>2</sup> *Ibid.* p. 313.

<sup>3</sup> *Ibid.* Vol. 3, p. 298.

986. It is therefore perfectly obvious that miasmata abound in these vessels ; and in them typhus fever is so common, that they are continually referred to as the source of almost all the fevers that appear on board the fleets of England.

Trotter says of receiving ships, "We trace infectious fevers (typhus 801) more frequently to them than to all other sources ; witness the account given by some of the *Orion's* people. Besides the new raised men sent from tenders, all recovered men from hospitals are sent hither till their ships return to port, or till they are otherwise disposed of."<sup>1</sup> Speaking of tenders, he says, "These vessels being partly fitted as a prison, for security, are not the best calculated for health."<sup>1</sup>

987. Ships of war, though under better discipline, are so filled with matters liable to putrefaction, are so crowded, not only with men but with live stock for the use of the crew, and are so constructed, as to require all possible attention, and great and systematic exertion of absolute authority to keep them free from the impure air continually generated in them.

988. Of the quantity of substances capable of fermenting which are contained in ships of war, the following extract of a letter of Mr. Neale, surgeon, will give some idea. "The holds of all vessels, particularly ships of war, contain large quantities of vegetable matter, in casks often insufficiently strong to prevent their contents from escaping, such as pease, oatmeal, cocoa, flour, sugar, and wood for fuel, and when united with a due proportion of humidity, so as to pro-

<sup>1</sup> Trotter, *Medicina Nautica*, p. 254.

duce a given change by putrefaction, a gas is evolved,"<sup>1</sup> &c.

989. The writer observes, that the casks are often not strong enough to prevent their contents from escaping. Some idea may be formed of the quantity sometimes scattered about, in rough weather at sea, from the following passage from Trotter. "The Colossus was the flag-ship of rear-admiral Pole, and sailed with the unfortunate squadron under the command of Sir H. C. Christian, which was obliged to return from contrary winds and severe weather, after being eight weeks at sea in February." "The lower-deck ports could not be opened during this time; and from the motion of the ship, and water shipped in the gales, the provisions and other articles had been spread about the hold, *to the quantity of forty or fifty ton*, according to captain Grindall's report, before the ballast was exposed. The consequence of this was the production of an atmosphere in the hold and well, unusually foul; no doubt, owing to the fermentation of the provisions, and the decomposition of the moisture. The officers and seamen employed in clearing the hold, were grievously afflicted with swellings about the sub-maxillary glands, and violent opthalmias; and were obliged to be relieved by others during this duty. Sometimes there was a necessity for standing fast, for some days, that the noxious vapour might be expelled."<sup>2</sup>

Though in this case an extraordinary quantity of these vegetable matters was loose in the hold; yet it is frequently the case, that a quantity lies scattered

<sup>1</sup> Bancroft's Sequel, p. 233.    <sup>2</sup> Trotter, Med. Naut. Vol. 1, p. 167.

about, sufficient to produce so great a degree of impurity of the air of the hold, that candles will not burn there.<sup>1</sup>

990. "There is no situation where so large a number of human beings is confined in so small a space as in a man-of-war."<sup>2</sup> There are moreover numbers of live stock. "Nothing" says Trotter, "has been so offensive on the decks of our ships as pig-sties."<sup>3</sup> A vast number of candles are also continually burning in the different parts of ships; from many of which daylight is for ever excluded.

In consequence of these things the temperature of a ship's hold is very high. It is stated by Mr. McCormick, surgeon of the *Immortalite*, that when the thermometer in the shade stood at 72 degrees, "the medium heat between decks, when the watch below were in bed, was 84 degrees."<sup>4</sup>

Trotter says, "The bread room is so hot, that there is scarcely a ship that does not condemn a quantity of cheese three or four times a year."<sup>5</sup> He says, "I consider the bread room of a ship, from its present pent up condition, the number of lights so frequently burning in it, and the noxious effluvia issuing from cheese, &c. as a species of volcano that is constantly throwing out pestiferous fumes to shorten and weaken life."<sup>6</sup>

991. In addition to all this, the construction of ships is necessarily such as to retain the dense gas arising from all these sources. A great number of people live in those parts of the ship which are below the

<sup>1</sup> Bancroft's Sequel, p. 232.

<sup>2</sup> Trotter, *Med. Nautica*, Vol. 1, p. 274. <sup>3</sup> *Ibid.* p. 279.

<sup>4</sup> *Ibid.* Vol. 3, p. 98. <sup>5</sup> *Ibid.* p. 279. <sup>6</sup> *Ibid.* p. 288.

surface of the water. Others have the benefit of air by means of the gun-ports in fine weather ; but in the boisterous northern Atlantic, this is, often for weeks, an advantage they cannot enjoy. Every night, too, all is shut up.

Trotter, speaking of a new arrangement on board of some ships, says, without the store-rooms and wings being arranged in this form, it is difficult to ventilate a ship below.

992. From this statement it is very evident, that vigorous and persevering exertions are necessary to keep ships free from the foul air continually produced by the various causes above mentioned. To induce all to make these exertions is impossible. Trotter, after all his efforts, (from 1793 to 1799), to induce those concerned to attend to these things, says, in the latter year, "At this moment the internal economy of many (ships) in the fleet, differs as much as the features of their officers."<sup>1</sup>

993. We shall now notice the instances in which typhus fever appeared on board the fleets of England, France, and Portugal, in the Channel ; as well as those in which it occurred on board of single ships ; and show, in those cases in which the situation of the ship is mentioned, that abundant sources of miasmata were present ; and that the times of its appearance were those in which miasmatic fevers appear.

994. On the first of June 1794, the English took a number of French ships of war, and found them very sickly.

"The Sans Pareil had particularly suffered. This

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 3, p. 150.



ship sailed from Brest, in a squadron, six weeks ago, with a complement of a thousand men on board; many perished in the early part of the cruise, and an hundred ill of the fever were sent into a corvette, whose guns were taken out for the better accommodation of the sick, to be carried to port.”<sup>1</sup>

“The Northumberland was next in point of sickness; but the others were more or less infected with typhus fever.”<sup>2</sup> These ships were “dirty to an extreme degree.” “It was told me” says Trotter, “that the lower-deck ports (of the *Sans Pareil*,) had never been opened from leaving the harbour till the day of action.”<sup>1</sup>

The weather was remarkably warm; the thermometer stood at 80 degrees in the latter part of June (966).

Here was abundant cause for the existence of miasmata; extreme filth, moisture enough, and excessively hot weather, with great crowding, and no ventilation to carry off the foul air as it was generated. The fever continued to affect the French after they landed. Their situation on shore was unhealthy, and numbers died. The fever ceased in October (966).

995. The English ships did not escape. They were however kept much cleaner than the French ships. But as it is impossible to keep vessels perfectly clean, on account of the crowd on board, their construction, &c. (990. 991), the excessively hot weather produced among them also a considerable number of cases. In some of them, Trotter does not say how many, yellowness of the skin occurred.<sup>3</sup> The surgeon of the

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 76.

<sup>2</sup> *Ibid.* p. 77.

<sup>3</sup> *Ibid.* Vol. 3, p. 218.

Majestic, Mr. Gillespie, in his report for July, observes, "The approach of the solstice, and the canicula, seemed to have considerable influence on the spreading of the complaint; as, notwithstanding the precautions used, many were attacked with it."<sup>1</sup>

996. Great efforts were made on board the English ships to get rid of the disease; "the decks were kept clean, and the whole inside whitewashed;" the bedding and clothes of the men were constantly aired; "fires were kindled in pots in the hold, well, and bread room; stoves in the orlop, cabletiers, and fore and after cock-pits. Care was taken that the circulation of air through the wings should not be interrupted; and, besides the common windsails, two stunsails were fitted for the fore and main hatchway, so that every corner below was pure and completely perflated by the air; some of these sails were kept trimmed during the night, so as to counteract the effects of the heat when the ports were down."<sup>2</sup>

By these strenuous exertions in cleaning, drying, and ventilating the ships, the disease was checked, but cases continued to occur,<sup>3</sup> and in the course of the summer eight hundred sick were sent on shore to Haslar hospital.<sup>4</sup> Under the date 27th of September, it is stated that the fever was at an end.<sup>5</sup> The fleet was cleared of sickness earlier than usual by sending on shore all the new cases as they occurred.<sup>6</sup>

997. The correspondence between the effect of the high temperature of the summer of 1794 by land and by sea, is worthy of particular attention. The same

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 3, p. 90.      <sup>2</sup> *Ibid.* p. 80.

<sup>3</sup> *Ibid.* Vol. 1, p. 86. 94.      <sup>4</sup> *Ibid.* p. 84.      <sup>5</sup> *Ibid.* p. 97.      <sup>6</sup> *Ibid.* p. 94.

high temperature which produced an epidemic fever on board the French and English fleets at sea, also produced an uncommon number of cases of typhus in Liverpool (951 table), a great mortality at Portsmouth (963, &c.), an epidemic typhus at Manchester (956); and no doubt the effect was general, as in 1764 (524).

998. The Portuguese squadron which was attached to the English Channel fleet, suffered severely with typhus fever in the same year, 1794.

These vessels were very dirty and badly ventilated. Trotter speaks of the contrast between them and the English ships in very strong terms.<sup>1</sup> They arrived in the Channel in August, and on the 16th, when he visited the squadron, the fever had already made its appearance.<sup>2</sup> On the 23d of September he visited these ships again, and found them all sickly, and the typhus prevailing among them,<sup>3</sup> and increasing fast.<sup>4</sup>

In consequence of this state of things they sailed for Plymouth in October, to refit and purify. "The Europe, a third-rate in ordinary, was allotted to them for an hospital, and fitted accordingly (in October); but from the numbers daily taken ill in all the ships of the squadron, she became so crowded, in the space of three weeks, that no room was left to receive more." In consequence of the extent of the sickness, Admiral de Valle requested Trotter to meet the physician to Plymouth hospital. He not appearing, Dr. Mein, of the Caton hospital-ship, attended. "There were at this time on board the Europe, five hundred people in

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 95.

<sup>2</sup> *Ibid.* p. 91. 92.

<sup>3</sup> *Ibid.* p. 95.

<sup>4</sup> *Ibid.* p. 96.

Note. At the bottom of the last page the reference should have been to the *first* Vol. instead of the *third*.

different stages of the fever." "The orlop-deck being full in every corner, from its very imperfect ventilation was literally pestiferous. The smell was intolerable,"<sup>1</sup> &c. This fever continued to prevail as a winter epidemic, but they so far recovered as to sail for Lisbon in February, leaving three hundred sick.<sup>2</sup>

999. An English army under Lord Moira embarked in October or November 1793, and sailed towards the coast of France; but not being able to land, they returned to England in the end of December very sickly with fevers and dysenteries.<sup>3</sup>

These troops were of course exposed for some time, at the place of embarkation, to the miasmata always present in such places at that time of the year.

The complement of three transports was crowded into two, and they were extraordinarily dirty; inso-much that "the soldiers themselves imputed their illness to the crowded dirty transports, and the confinement during bad weather."

Every circumstance was calculated to produce the effect that followed. Exposure to miasmata in the low seaports, and afterwards excessive crowding in transports at that time of the year, October and November, when miasmata abound, particularly in the heated holds of transport ships (985 to 991), followed by bad weather at sea in December, could not fail to produce such disease.

The presence of *miasmata* is not only a fair inference from the circumstances, but is manifest from the presence of *miasmatic diseases* in company with ty-

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 99.

<sup>2</sup> *Ibid.* p. 101.

<sup>3</sup> *Ibid.* p. 191.

phus fever. "There were a larger number of bad cases in typhus, *ague*, and *dysentery*, than come usually to a naval hospital at one time."<sup>1</sup>

1000. "The combined fleet of French and Spaniards, when off Plymouth, in *summer* 1779, were overrun with a contagious fever (typhus 801), which made them leave the Channel."<sup>2</sup>

1001. In the *summer* of 1793, the fever appeared on board the *Orestes* brig lying at Plymouth.<sup>3</sup>

1002. In June 1795 a typhus fever appeared on board the *Prince*.<sup>4</sup> In July it appeared on board the *Orion*. It affected principally, perhaps entirely, landmen lately received. They had been confined on board a receiving-ship so crowded that they could not hang up a hammock, and "they conceived their diseases to have been caused by sleeping on the deck." The process described above (996) was executed on board this ship, and no fresh case of fever appeared afterwards.<sup>5</sup>

1003. It is frequently mentioned in Trotter's work, that landmen especially are liable to be attacked by typhus on board the ships of war, and that the disease is often confined to them, the old hands escaping altogether. It is evident from the state of things on board these vessels, described above (984 to 992), that the air of the hold, &c. is always more or less impure, and that, whenever the exertions to purify it are relaxed, it is considerably so. To this the sailors, who have been long on board, have become familiarized, insomuch that it produces on them less effect than on

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 192.    <sup>2</sup> *Ibid.* p. 205, note.

<sup>3</sup> *Ibid.* p. 178.    <sup>4</sup> *Ibid.* p. 135.    <sup>5</sup> *Ibid.* p. 136. 137.



those lately entered who have been accustomed to a purer air. This is no more than what is every day observed with respect to the effect of the air of certain islands, on those accustomed to a purer state of the atmosphere. Those who visit these islands, are certain to feel the effects of it, to pass through a seasoning, to suffer an attack of the fever produced by miasmata, when in force. So those who accustomed to a purer air, enter on board a ship of war, particularly in warm weather, are likely to suffer an attack of fever. As the fever in the islands is, for the most part, confined to new comers, and does not affect the acclimated except in very hot seasons; so the typhus on board these ships is often confined to the men lately entered, and the old hands escape. Of this the *Medicina Nautica* affords a considerable number of instances.

1004. In June 1796 a fever appeared on board the *Niger*. She lay at Spithead; the only circumstance mentioned, leading to a knowledge of her situation, is, that seven of the men returned from Haslar hospital relapsed.<sup>1</sup>

1005. In September typhus fever appeared on board the *Glory*. The hold of this ship "was extremely foul, and had not been cleared when the fever made its appearance."<sup>2</sup> The means employed to subdue it were those before described. The fever extended to thirty-seven persons, and *all the cases being sent on shore*, and no new case occurring after the twenty-ninth, the ship was clear of the fever by that day.<sup>3</sup>

1006. The case of the *Colossus* has been mentioned already (989). Some time after the period mentioned

<sup>1</sup> Trotter, *Med. Nautica*, p. 155.    <sup>2</sup> *Ibid.* p. 167.    <sup>3</sup> *Ibid.* p. 161.

in the former notice she was fitted up for a cruise off Ushant, from which she returned on the sixth of October after an absence of seven weeks.<sup>1</sup> She must therefore have sailed about the eighteenth of August, and the fitting up must have been in the heat of summer. While she was repairing in Plymouth harbour, in July and the forepart of August, the typhus fever broke out three or four times among her crew, composed entirely of raw Irish landmen. It was kept down by sending the sick on shore immediately on being attacked, and by airing the ship well.

Towards the end of the cruise off Ushant, viz. about the last of September, the fever appeared again;<sup>2</sup> and between the sixth of October, when she arrived, and the last of that month, she sent on shore thirty cases of typhus. After the first of November no new case appeared.<sup>3</sup>

In this case the ship was foul; and the time of the rise and of the cessation of the fever corresponds with the time, when, in like circumstances in this or any southern climate, a miasmatic fever would have arisen and have ceased. The want of uniformity in the progress of the fever, in this and other cases on board of ships of war, is to be attributed to the efforts made to clean, to dry, and to ventilate them; and also to sending the sick on shore.

1007. In the same years, 1794, '95, and '96, instances of typhus fever occurred on board of ships, in those seasons of the year in which the winter epidemics appear on land, and with the precise symptoms observed

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 162. 163.

<sup>2</sup> *Ibid.* p. 164.

<sup>3</sup> *Ibid.* p. 165.

at the same time on land, viz. "a combination of the symptoms of typhus with pneumonia."<sup>1</sup> These will be stated hereafter.

We shall now inquire into the situation of these ships as to exposure to miasmata, in the autumn previous to the winter in which they were afflicted.

1008. A number of ships are mentioned by Trotter as afflicted with typhus fever in the winter of 1793-4. The *Russel* and *Invincible* in the last of December landed a number of men ill with this fever.<sup>2</sup> The *Raisable* had been long at sea in bad weather. In January she landed upwards of an hundred ill of typhus and dysentery. Previous to this she had landed at one of the Western Isles one hundred and seventy.<sup>2</sup> The *Gibraltar* sailed in November from Plymouth, and after a cruise of some weeks in stormy rainy weather, she was obliged to return to port, and landed a number of cases of flux and fever.<sup>3</sup>

In the last of February the *London* sent some cases of typhus to the hospital.<sup>4</sup> In March the *Valiant*, the *Cæsar*, and the *Leviathan*, landed a considerable number of cases of typhus; fifty cases were sent in the second week of the month from the *Valiant* alone, and five cases in one day from the *Cæsar*.<sup>5</sup> In March a fever of uncommon malignity prevailed on board the *Hebe*.<sup>6</sup> In the last of March the typhus appeared on board the *Robust* and *Colossus*;<sup>7</sup> about the first of April on board the *Africa*;<sup>5</sup> and in the course of the month on board the *Arrogant*.<sup>8</sup>

<sup>1</sup> Trotter, *Medicina Nautica*, passim.

<sup>3</sup> *Ibid.* p. 58.

<sup>4</sup> *Ibid.* p. 59.

<sup>6</sup> *Ibid.* p. 60.

<sup>7</sup> *Ibid.* p. 63.

<sup>2</sup> *Ibid.* Vol. 1, p. 57.

<sup>5</sup> *Ibid.* p. 61.

<sup>8</sup> *Ibid.* p. 67.

In April the fever on board these ships was on the decline ; in some of them extinct.<sup>1</sup> On the first of May the whole fleet was in perfect health.<sup>2</sup>

1009. It is apparent on the face of this statement, that the fever prevailed most in the beginning and the breaking of winter ; and in the interval between, the cases were comparatively few. Thus, in the four ships first mentioned, the disease appeared in December. A few are mentioned on the 23d of February on board the London, but it was in March that the fever became general. This corresponds with the periodical increase and decrease in that year on land ; thus, in Liverpool, in November 1793, there were 224 cases entered on the register of the dispensary ; in December, 228 ; in January 1794, 157 ; in February, 230 ; and in March 338 cases (951, table).

1010. With respect to the situation of these ships, a few particulars only are mentioned respecting some of them, but we know generally that war was declared by the French early in 1793, and the presumption is that the ships were not in the best order as to cleanliness after lying by for years. They were moreover through the following months fitting up in port ; the crowds of sailors suddenly collected together, and not yet brought to order, produced a vast deal of filth ; and in every way their situation was such as, we have shown, to expose them to the action of miasmata. Trotter, speaking of the sickly state of one of the ships, says, it “ was too much the case with other ships at the beginning of the war. The hurry and bustle which take place at the early stage of all armaments, have produced similar disasters among new levied men.”<sup>3</sup>

<sup>1</sup> Trotter, Med. Naut. Vol. 1, p. 66. <sup>2</sup> Ib. p. 69. <sup>3</sup> Ib. Vol. 2, p. 143.

1011. This view of the state of these vessels is confirmed by the particulars we have found scattered through Trotter's narrative of the health of the fleet.

The Hebe frigate was always remarkably leaky in her upper works; and it is observable that the fevers on board this ship were "of uncommon malignity" (1008).

The crew of the Robust and Colossus (1008), were living at the time that the cases occurred among them in a hulk, of which they complained, Trotter says, with justice; as she was left "in a very wet and dirty condition by the ship's company that had occupied it before."<sup>1</sup>

The decks and beams of the Arrogant (1008), were remarkable for their moisture. "This uncommon dampness was probably very much owing to the spot where she lay in ordinary, *which was surrounded with swamps.*"<sup>2</sup> Her crew was newly raised.

These circumstances show such great inattention to the situation of the ships, that it is highly probable that all were much in the same condition.

1012. The typhus fever appeared on board the Vengeance in January and February, 1793.

This vessel had been a guard-ship at Chatham. In the beginning of January she was to proceed to Portsmouth fully manned; and received four hundred men additional to carry to the fleet. The passage was long; the weather rainy and boisterous.<sup>3</sup> The men were of course, from the crowd, and the weather, very much confined. The disease affected very few of the able seamen,<sup>4</sup> and was almost confined to the new

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 63.

<sup>2</sup> *Ibid.* p. 68.

<sup>3</sup> *Ibid.* p. 186.

<sup>4</sup> *Ibid.* p. 210.



raised men, Irish landmen (1003), the dregs of jails in the Metropolis.<sup>1</sup> Two hundred of these men were from the frigate *Nemesis*. She had been employed for two months in carrying new raised men between Sheerness and Spithead, and sometimes as a receiving-ship at the Nore; there were seldom less than two hundred men on board, besides her complement, most of them landmen very badly clothed. Captain Ball was very attentive in using means for cleaning and ventilating, and with great success. Mr. Fleming, the surgeon, says, "No fever appeared in my time. But in February she became so sickly, that her whole crew were sent to Haslar hospital."<sup>2</sup>

It is unnecessary to repeat the observation that these circumstances were calculated to produce miasmata, and the corresponding diseases. That they did so, is manifest from the circumstance here also mentioned by Trotter, that some cases of the remittent and intermittent type were observed.<sup>3</sup>

1013. In January 1790, the *Gorgon* of 44 guns arrived at Portsmouth with a number of troops on board from Chatham.<sup>4</sup> While she lay in the harbour a fever prevailed among the soldiers; but not one of the seamen was affected.<sup>5</sup> The fever had prevailed at Chatham when they were embodied. The situation of that place is such that miasmata abound in the autumnal season, and it is to be presumed that these men must have been there in that season as they were embodied there. As landmen, moreover, exposed to the air of the hold of a ship (1003), especially as

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 187.    <sup>2</sup> *Ibid.* Vol. 2, p. 21.

<sup>3</sup> *Ibid.* Vol. 1, p. 187.    <sup>4</sup> *Ibid.* p. 209.    <sup>5</sup> *Ibid.* p. 210.

they occupied the lower-deck, in which situation they were most exposed to the dense gas called miasmata, it is not wonderful they were sickly ; nor that the seamen, who were acclimated (1003), and moreover had that situation in which miasmata would be least likely to reach them, and in which they were nearer the pure air, should escape.

1014. The typhus fever prevailed on board the *Powerful*, while cruising off Ushant, from the first of October to the last of December. In October there were twenty cases, November seven cases; "towards the end of December and beginning of January, there were sixty-eight cases." A dysentery accompanied the fever towards the last.

Dr. Trotter, with the surgeon, attributes "the increase latterly to wet decks, confined air, the scuttles being shut, and the decks leaking above, during stormy weather."<sup>1</sup> These circumstances were well calculated to produce a winter epidemic among men under the influence of miasmata ; as these, from the time when it began, October, and the accompanying disease, dysentery, undoubtedly were. On comparing this fever with that which prevailed in Liverpool (951), we find a remarkable coincidence.

1796.	In the <i>Powerful</i> .	In Liverpool.
October	20 cases.	329
November	7	153
December	A great increase.	247

1015. In March 1797, the typhus fever prevailed on board the *Minotaur*. No circumstances of her situation are mentioned.<sup>2</sup>

1016. In March the typhus fever appeared on board

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 2, p. 14.      <sup>2</sup> *Ibid.* p. 17.

the frigate *La Nymphe*. About the end of the month she landed seventeen sick at Plymouth, and sailed for Spithead. The surgeon there left her, about the middle of May. His successor did not join her till two months afterwards (in July<sup>1</sup>), who found the fever still prevailing, and it was the beginning of September before it was completely extirpated.”<sup>2</sup> No circumstances are mentioned respecting the situation of this vessel in the autumnal season of 1796, nor of her state as to cleanliness. The fever however commenced at one of those periods of the year remarkable, by sea and land, for the appearance of typhus. Its continuance is not surprising when we consider the situation of all ships of war, requiring the strictest discipline and continual care in cleaning, and ventilating, in connexion with the circumstances of the anarchy Trotter states to have prevailed on board early in May, and that of her surgeon having been absent for two months in the hot weather.

The extermination of the fever was effected as early as the first of September by the means before stated (996), of thoroughly cleaning, drying, and ventilating the ship, and by sending on shore every case as it occurred.

1017. In April and May 1797, the typhus fever appeared on board the frigate *La Pique*. She had been lying during those two months in Plymouth harbour, undergoing repair. The fever affected the landmen alone.<sup>2</sup> None of the old hands were seized<sup>3</sup> (1003).

1018. In the summer (June or July,) 1797, ten ca-

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 2, p. 58.

<sup>2</sup> *Ibid.* p. 21.

<sup>3</sup> *Ibid.* p. 24.

ses of typhus occurred among the landmen on board the *London*<sup>1</sup> (1003).

1019. The typhus fever prevailed on board the *Saturn* early in March 1799.<sup>2</sup> No cases appeared after the 12th of May.<sup>3</sup> In the forepart of this time, previous to the 16th of April, she was at sea, in weather cold for the season, with sharp easterly winds; after that in Cawsand bay. The crew were not remarkable for cleanliness,<sup>4</sup> and before she sailed the men indulged to excess in intoxication, and were in the habit of lying in exposed places, even when the decks were wet. After her arrival they again indulged in drinking to excess. They also laboured very hard from the 29th of April to get the ship ready to put to sea as soon as possible; they did not sleep more than four hours, and some of them were not in bed more than one hour in the twenty-four. They were also much exposed to getting wet at this time. The ship too was very dirty, and full of lumber. This was in May. These men were exposed to a variety of remote causes of fever, and under these circumstances the fever increased rapidly.<sup>5</sup>

1020. A typhus fever appeared in December and January in the *Edgar*. The ship leaked much in the upper works, and the people were constantly wet.<sup>6</sup> This state of the ship must have given rise to the production of miasmata in warm weather, and under the joint operation of this remote cause, and of the cold and wet weather, was produced the fever, which "seemed combined with both pneumonic and catarrhal symp-

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 2, p. 26.      <sup>2</sup> *Ibid.* p. 147.

<sup>3</sup> *Ibid.* p. 149.

<sup>4</sup> *Ibid.* Vol. 3, p. 55.

<sup>5</sup> *Ibid.* Vol. 2, p. 147, 148.

<sup>6</sup> *Ibid.* Vol. 3, p. 63.

toms ; and, in some, assumed the form of dysentery." It affected half the ship's company.

1021. On the 26th of September 1799, the *Uranie* frigate arrived from her station off Brest on account of a general fever on board.<sup>1</sup> This frigate was leaky in her upper works.<sup>2</sup> See the effect of this in a preceding case (1011). October sixth the Captain arrived in Cawsand bay, having typhus fever on board. She had experienced much bad weather, and was also leaky in her upper works.<sup>3</sup> Mr. Farquhar, the surgeon, in his report for May, says, "During the winter some typhoid cases were constantly in his list, without showing a disposition to spread much ; some cases of dysentery are also mentioned to have discovered themselves. Twenty-five in both complaints are the number for May."<sup>4</sup> The general disposition to fever nearly disappeared as the warm and settled summer weather approached.<sup>5</sup>

1022. In the end of December 1799, the typhus appeared on board of the *Cæsar*, during strong gales, with rain, sleet, and snow.<sup>6</sup>

In March and April 1800, it was general in the fleet,<sup>7</sup> the weather being cold, tempestuous, and rainy ;<sup>8</sup> as the weather became settled it declined.<sup>9</sup>

1023. In December, and in January 1801, the typhus fever appeared on board of several ships,<sup>10</sup> the crews of which had lived in hulks.<sup>11</sup> In March and April 1801, it was again general in the fleet.<sup>12</sup>

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 3, p. 59.    <sup>2</sup> *Ibid.* p. 151.

<sup>3</sup> *Ibid.* p. 153. 60    <sup>4</sup> *Ibid.* p. 160.    <sup>5</sup> *Ibid.* p. 69.    <sup>6</sup> *Ibid.* p. 155.

<sup>7</sup> *Ibid.* p. 160. 162. 163. 164. 166. 169. 174. 221.

<sup>8</sup> *Ibid.* p. 233.    <sup>9</sup> *Ibid.* p. 69.    <sup>10</sup> *Ibid.* p. 130. 186. 191. 192.

<sup>11</sup> *Ibid.* p. 188.

<sup>12</sup> *Ibid.* p. 194 to 209.



1024. In addition to the causes commonly acting at this time of the year, a scarcity of food pressed hard on the poor, and drove numbers into the naval service, "who seemed to have entered to prevent themselves from starving: many of these have been invalided as unfit objects for the service." "Depressed in mind by their distresses, worn down by poverty and want of food, and half naked, these unfortunate beings had been crowded into the dark and confined decks of tenders."<sup>1</sup> Here is a combination of some of the most powerful remote causes of fever, and considering their general action, abundantly sufficient to produce the general fever which prevailed in the fleet.

1025. About the first of June 1802, the Malta was commissioned in Portsmouth harbour; and while lying there fitting, and completing the crew, on the twelfth of July the typhus fever broke out violently and suddenly; many patients having yellowness of the skin, as in miasmatic fevers.<sup>2</sup>

1026. The Donegal was commissioned at Plymouth in August, and fitted out with great expedition and fatigue. Towards the end of that month and the beginning of September, typhus fever appeared. She sailed on the second of October, when the fever cases became more frequent. She went to Torbay early in November, and sent on shore about twenty cases, and the rest recovered on board.

1027. It is evident from these statements that the typhus fever appears on board of ships at sea, or in port, in circumstances in which miasmata abound, and at those times in which miasmatic fevers appear. Ex-

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 3, p. 194.

<sup>2</sup> *Ibid.* p. 215.

cepting the month of March, much the greater part of the instances in which the fever appeared, was in the summer and autumn. It was general in the hot summer of 1794 in the English, French, and Portuguese fleets; in the summer of 1779 in the French and Spanish fleets off Plymouth; and at no other time of the year is it mentioned as having been general, but in March and April, 1800 and 1801. The reason why the fever is more prevalent at this period of the year by sea than by land, is, that the people are infinitely more exposed to the weather by sea. On land in bad weather, all, who can, avoid the weather. By sea, that is the very time when the greatest exertions are necessary, and the men are much more exposed than at any other time. The equinoctial gales in March, therefore, produce a general fever if the sailors are under the influence of miasmata.

1028. The symptoms of typhus fever as stated by British writers, are those produced by miasmata (940). This will need no further evidence than the following extracts.

1029. Dr. Currie, of Liverpool, has published in his Medical Reports a letter from Mr. Marshall, the surgeon of the Cheshire regiment of militia, respecting a typhus fever which prevailed among the men while in barracks at Gosport. The following is the statement of the symptoms observed. "The first symptoms were a dull head-ach, with restlessness and shivering, pains in the back and all over the body, the tongue foul, with great prostration of strength. The head-ach became gradually more acute; the heat rose to 102 and 104 degrees, and in one instance to 107 degrees; and in

general the restlessness increased to delirium, particularly in the night.”<sup>1</sup>

1030. Dr. Currie himself, speaking of a fever which prevailed at Stapleton, says, “The fever was evidently typhus in a malignant form. In such patients as I examined, there were head-ach, dull, and sometimes blood-shot eyes, much disturbance of the functions of the mind, great prostration of strength, and very generally petechiæ. The pulse was not very strong; in frequency it ran from ninety to one hundred and twenty in a minute; the skin was dry; the heat varies in different patients.”<sup>2</sup> In another place he mentions a dull red suffusion of the adnata.<sup>3</sup>

1031. Dr. Trotter, in his *Medicina Nautica*, has published the reports of a number of surgeons of the English Channel fleet, made to him as physician of that fleet.

1032. The surgeon of the *Uranie*, Mr. Perkins, remarks, in his account of a typhus fever on board of that ship in September, “this fever had two kinds of attack, or orders of symptoms; differing only perhaps in the particular constitution of the patient.

“The first is attended by violently increased action, with seemingly great determination of blood to the head, with strong and distressing pulsation of the carotids and temporal arteries; full distended countenance; tunica conjunctiva inflamed; eye-lids heavy and tongue large; *hard* and apparently oppressed pulse, universal pains, hot skin, tinnitus aurium.

“In the other, the animal functions are evidently impaired; the features are shrunk, and the whole coun-

<sup>1</sup> Currie's Med. Reports, p 310.    <sup>2</sup> Ibid. p. 388.    <sup>3</sup> Ibid. p. 25

tenance expressive of a dejection of mind, in some instances amounting to terror; great pain and heaviness over the eyes; pain in the small of the back; anxiety; tongue small and white; nausea; skin dry, but not unusually warm; sometimes giddiness and imperfect vision; pulse small and quick: costiveness precedes both attacks."<sup>1</sup>

1033. Mr. Farquhar, surgeon of the Captain, says, "The symptoms are severe head-ach, and giddiness, sickness or pain at the stomach, sensation of cold in the back and loins, great weakness, and general uneasiness over the body; the eyes and countenance dejected. These complaints are succeeded by frequency of the pulse and hot skin; the tongue becomes foul and dry, and the patient is frequently seized with delirium. The belly is in general regular, though some have had a troublesome diarrhœa."<sup>2</sup>

1034. Mr. Carruthers, surgeon of the Malta, says, "The men on the attack were instantly seized with nausea; uncommonly violent head-ach; syncope; lassitude over the whole body; yawning; tongue and lips and fauces much parched; pulse low, quick, and unequal; great anxiety, with cold clammy sweats. Vomiting was urgent in some, but diarrhœa did not accompany it, as I have before seen. Some of the patients had involuntary crying, and shedding of tears, like nervous or hysterical women."<sup>3</sup> Many of the sick had yellowness of the skin, insomuch that he suspected that the yellow fever had been introduced by communication with a sickly ship from the West Indies.<sup>3</sup>

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 3, p. 151.

<sup>2</sup> *Ibid.* p. 154.

<sup>3</sup> *Ibid.* p. 215.

In commenting on Mr. Carruther's observation, Trotter says, "The disease is not of the kind alluded to. Icterus is not an unfrequent symptom in typhus; it was particularly remarked among our seamen in the warm summer of 1794."<sup>1</sup> In another place he says, "I have often seen the eyes and skin, with the urine, as deeply tinged by the bile in typhus, as I have remarked it in the yellow fever of the West Indies."<sup>2</sup>

1035. Mr. Gray, of *La Nymphe*, says, "The symptoms of this fever were cold shivering alternated by heat; head-ach; pains of the back, knees, shoulders, and breast; sickness at stomach; pulse weak and frequent; tongue foul; thirst; loss of appetite; dejection of spirits; and great debility."<sup>3</sup>

1036. Mr. Dunn, of the *Circe*, says, "Some of our best men became daily affected in a similar manner; want of appetite, nausea, a foul tongue, some degree of tension of the skin, with costiveness, were the most observable appearances."<sup>4</sup>

1037. Mr. Kenning, of the *Invincible*, says, "They complained of chills, nausea, and head-ach: one had a severe pain over the left eye, which lasted for a few hours, and then shifted to the other, and so on alternately."<sup>5</sup>

1038. Mr. Johnstone, of the *Saturn*, says, "Sickness at stomach, and a peculiar pain of the abdomen were common attendants of this disease: but neither diarrhœa, dysenteric symptoms, or constipation were observed."<sup>6</sup>

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 3, p. 218.    <sup>2</sup> *Ibid.* Vol. 1, p. 259.

<sup>3</sup> *Ibid.* Vol. 2, p. 58.

<sup>4</sup> *Ibid.* Vol. 1, p. 80.

<sup>5</sup> *Ibid.* Vol. 1, p. 109.

<sup>6</sup> *Ibid.* Vol. 3, p. 55.



1039. Mr. McArthur, of the Belleisle, says, "When it proved fatal, it happened as early as the fourth or fifth day. In these cases, I understand, there was an acute pain of the abdomen from the first attack, which remitted a few hours before death."<sup>1</sup>

"Nearly all the seamen's wives suffered from the disease; in whose constitutions it first appeared by sore throat, determination to the head, and amenorrhœa."<sup>2</sup> The last symptom is very common in some of our epidemics.

1040. The attack is sometimes ushered in with vertigo, palpitations of the heart, delirium, and convulsions;<sup>3</sup> and sometimes instant death occurs.<sup>4</sup>

"The sensation of cold on the surface of the body, in some cases, continues for a length of time; but in others wears off in a few hours, and is alternated with heats, that seldom produce moisture on the skin and sweating. The skin itself soon acquires a sallow hue, and is dry and shrivelled. The sensation of cold is not however a constant attendant of the accession; I have seen many where no rigor was perceptible."<sup>5</sup>

1041. With regard to the state of the contents of the bowels, Trotter says, "The stools are commonly offensive;"<sup>6</sup> and in Hamilton's cases, though the mention of the colour, &c. of the passages, is frequently omitted, it is stated several times that they were dark, green, fetid,<sup>7</sup> &c. In a case stated by Darwin, the passages were green.<sup>8</sup> Ferriar mentions green matter being thrown up by a patient of his.<sup>9</sup>

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 3, p. 209.

<sup>2</sup> *Ibid.* p. 102.

<sup>3</sup> *Ibid.* Vol. 1, p. 255.

<sup>4</sup> *Ibid.* p. 266.

<sup>5</sup> *Ibid.* p. 281.

<sup>6</sup> Hamilton on Purgatives.

<sup>7</sup> Darwin's *Zoonomia*, Vol. 2, p. 490.

<sup>8</sup> Ferriar's *Medical Histories*, p. 71.

1042. Trotter mentions as dangerous symptoms of typhus, early delirium; the pupil of the eye dilated and insensible; hickups; subsultus tendinum; the fæces and urine passing insensibly; urine, before pale, becoming black and grumous; hemorrhages; a yellow, darker colour of the skin, increased fetor of the breath.<sup>1</sup>

The yellowness of the skin, he particularly observes (1034), is sometimes as deep as he has seen it in the West Indies.

1043. The latter stage of the disease is marked by the patient "lying on his back; loss of voice; tremulous motion of the tongue on putting it out; indistinct vision; want of perception; muttering to himself; catching and picking the bed clothes; moaning, sighing, weeping, sometimes laughing; difficult deglutition; paralysis of the sphincter muscles; tremors; convulsions; syncope on being raised upright; singultus; cold sweats, as they are called; gangrene of blistered parts, of wounds, and sometimes of the extremities; hemorrhages, intolerable stench of the breath and excretions; the skin dusky or yellow, petechiæ, vibices; vomiting of a black matter; the stomach rejecting every thing immediately as swallowed; profuse diarrhœa; dark coloured urine; glassy appearance of the eye; the eye-balls fixed, sunk; the countenance shrunk, lengthened, ghastly, and discoloured; the inside of the mouth and tongue black and parched; the mouth drawn aside, and tongue hanging out; deafness, or hearing very acute; the jaw fallen; immobility of the joints; watchfulness or constant sleep; heaving of the breast;

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 259.    <sup>2</sup> *Ibid.* p. 262. 263.

rattling of the throat; pulse felt only at intervals: *conclamatum est.*"<sup>1</sup>

1044. Every man of experience will perceive the identity of these symptoms with those of our autumnal fever. There is not one symptom which has not occurred under my own observation, except the mouth being drawn aside, and the tongue hanging out. This only I would observe, that the symptoms of the latter stage are rarely seen; only indeed when evacuations have been neglected, through the perverseness or ignorance of the patient or his friends. When evacuations are neglected, these symptoms are sure to appear in cases of any severity.

1045. Trotter remarks in several places, that the young and robust are more liable to be attacked than those of an opposite age and condition.

It is worthy of observation, that even in those who do not suffer an attack, the skin becomes sallow in the atmosphere of a ship, as in southern climates.<sup>2</sup>

1046. The typhus, we have seen, has its corresponding winter epidemic, which appears, as our winter epidemic does, in the beginning and end of winter. Ours is a combination of the symptoms of the autumnal fever, with symptoms resembling those of pneumonia, or catarrh. The typhus of winter is a combination of the symptoms of typhus with the same<sup>3</sup> (957).

Ferriar, speaking of the epidemic fever of the winter of 1789, and spring of 1790, says, "The symptoms were pain in the head, back, and limbs; sickness; cough; and in several towards the end of winter, great

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 274.

<sup>2</sup> *Ib.* Vol. 2, p. 14. & Vol. 3, p. 442. <sup>3</sup> *Ib.* Vol. 3, p. 157. 191. 193.

pain and difficulty in voiding urine," &c. Compare this with the account heretofore given of the winter epidemic of the southern states (610. 613).

1047. Typhus fever appears in company with miasmatic diseases, and they are mutually convertible into one another (940).

1048. The different forms of miasmatic fever; viz. remittents, intermittents, with those in which some aggravated symptom has given rise to a distinguishing name, as dysentery, diarrhœa, or cholera; all appear in company, as effects of the same cause, and are mutually convertible, any one into any other (660, &c.). So also, as the following testimony from writers of credit fully establishes, the typhus fever, intermittents, dysentery, diarrhœa, and cholera, appear in company, by sea and by land, and are mutually convertible into one another.

1049. Ferriar says, "I have seen cholera converted to typhus, and as might be expected, a long and dangerous fever produced. There was an uncommon appearance of stupor at the first attack of cholera, which continued and increased after the symptoms of that disease were abated, but the brown list on the tongue did not appear till several days afterwards. Dysentery and diarrhœa are often converted to continued fever; but diarrhœa may be considered almost as a symptom of the feverish disposition, and as the forerunner of typhus."<sup>2</sup>

1050. Ferriar also mentions an epidemic colic which was followed by a typhus fever (956).

1051. Pringle, in his account of the diseases of the

<sup>1</sup> Ferriar's Medical Histories, p. 70.

<sup>2</sup> Ibid. p. 138.

campaign in Germany in 1743, says, "The state of those at Feckenheim has been already mentioned: there the hospital-fever (the typhus, 801), and dysentery grew daily worse. Few escaped; for however mild or bad the flux was, for which the person was sent to the hospital, this fever almost surely supervened."<sup>1</sup>

1052. He states that the English army, (which had been exposed to the influence of miasmata during the whole autumnal season,) on its voyage home in November was detained at sea, and some of the men were taken ill with the remitting fever, which, by the crowded state and confined air of the hold, was soon converted into the jail-fever (typhus, 801).<sup>2</sup>

1053. Ferriar says, "In one case, where a typhus was unusually protracted, after several hazardous determinations to the stomach and bowels, the fever assumed the form of an intermittent,"<sup>3</sup> &c.

1054. Dr. Gomez, physician to the Portuguese fleet, in a letter to Dr. Currie, mentions a case in which "it appeared as if a typhus was transferred into a dysentery."<sup>4</sup>

1055. In the following quotations from Trotter, he is speaking of the typhus fever. He says the ship *Raisonable* arrived at Spithead in January 1794, after having been long at sea, and "landed upwards of a hundred, very ill of typhus and dysentery." "A considerable number of cases in flux and (typhus) fever, were received from the Gibraltar."<sup>5</sup>

"The cases (of typhus on board the *Valiant*,) were

<sup>1</sup> Pringle on the Diseases of the Army, p. 25.      <sup>2</sup> Ibid. p. 39.

<sup>3</sup> Ferriar's Medical Hist. p. 82.      <sup>4</sup> Currie's Medical Reports, p. 335.

<sup>5</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 58.



becoming milder ; in some, it put on an intermittent form, which showed that it was now on the decline."<sup>1</sup> This observation shows that the occurrence was a very familiar one.

"Those cases (of typhus) which have occurred latterly, have been slight, with a very general intermittent tendency."<sup>2</sup>

"The Royal George did not seem to suffer much from the infection." "They assumed a bilious remittent form,"<sup>3</sup> &c. "What cases appeared at this time were either with distinct remissions,"<sup>4</sup> &c.

"I have seen a family, where the father was labouring under an obstinate tertian, while the mother and some of the children were ill in bed with a typhus." "Nay, I have constantly remarked in those ships, where contagion (typhus) prevailed, that many cases of regular intermittents and remittents occasionally appeared. When they increased (in number) in proportion to the number of the continued type, and the latter becoming milder in its attack, I consider it as an infallible sign that the power of the infection was on the decline, and would be speedily subdued."<sup>5</sup>

"About the beginning of March the infection seemed to be on the decline ; which appeared from the attacks being less severe : some cases of the remittent and intermittent type were now observed."<sup>6</sup>

"The sick list consisted of seventeen venereal patients, and seven in fever, some of them regular tertians," &c. "Some were every morning discharged to duty, and others added in the course of the day, in both the continued and intermittent forms."<sup>7</sup>

<sup>1</sup> Trotter, Med. Naut. Vol. 1, p. 66.    <sup>2</sup> Ibid. p. 70.    <sup>3</sup> Ibid. p. 83.

<sup>4</sup> Ibid. p. 85.    <sup>5</sup> Ibid. p. 185.    <sup>6</sup> Ibid. p. 187.    <sup>7</sup> Ibid. p. 188.

“The attacks of fever, since leaving Cork, had been more numerous than on the preceding week. They were both of the continued and intermittent types.”

“There were a larger number of bad cases in typhus, ague, and dysentery, than come usually to a naval hospital at one time. From the same transport, and in the same regiment, were brought people ill of the three diseases just mentioned.”<sup>1</sup> On board the *Powerful*, “a dysentery was associated with the fever.”<sup>2</sup> “It is not easy to trace those circumstances, which occasionally convert an intermittent or remittent fever into a continued type (or typhus); and vice versa. There must however be something in their disposition very much alike; for wherever we find typhus affecting a number of people at a time, we also find cases of the remittent and intermittent form.”<sup>3</sup>

1056. These quotations fully establish the fact, that the fever called typhus and miasmatic fevers arise together under the operation of the same circumstances, and that these diseases are convertible into one another.

1057. From the same statements it is also evident, that the typhus fever of England bears the same relation with our remittent fevers, to intermittents, to cholera, to colic, diarrhœa, and dysentery.

1058. Typhus fever also, like our miasmatic fevers, sometimes terminates in dropsy. Ferriar says, “In particular seasons conversions to dropsy succeed most cases of typhus.”<sup>4</sup> Speaking of the epidemic of 1792, he says, “Conversions to dropsy were much more common than usual in this epidemic.”<sup>5</sup>

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 192.

<sup>2</sup> *Ibid.* Vol. 2, p. 14.    <sup>3</sup> *Ibid.* Vol. 1, p. 311.

<sup>4</sup> Ferriar's *Medical Histories*, p. 152.    <sup>5</sup> *Ibid.* p. 232.

1059. The single consideration, that intermittents are convertible into typhus (1056), strongly indicates, perhaps it should be said, clearly shows the miasmatic origin of the latter. If the fever be first an intermittent, and then a typhus, its origin is not changed; the typhus fever originated in miasmata.

1060. The doctrine however rests not on this ground alone. It has been shown, that typhus fever arises in situations in which miasmata abound (941, &c.), that in the time of its rise and fall, its greatest height and lowest declension, it corresponds with the miasmatic fevers of temperate climates, and that the same kind of weather is favourable to the increase of both (949, &c.); that the symptoms of typhus fever, are those of autumnal or miasmatic fevers (1028, &c.); that typhus fever appears in company with miasmatic diseases, and that they are mutually convertible into one another (1047, &c.). Whence it is evident that typhus fever is produced by miasmata (940).

1061. The typhus is a remittent fever. Cullen, in his observations on the subject of the continual fever of nosological writers, doubts whether, in forty years' practice, he ever saw such a fever; and says that almost always there are even daily exacerbations and remissions in the most continued fever:<sup>1</sup> wherefore he makes remissions and exacerbations a part of his definition of continual fevers; under which head he arranges typhus.

1062. It is evident from the above statements that

<sup>1</sup> Synopsis Nosologiæ, &c. Vol. 2, p. 66, note. "Fere semper in febribus, maxime continuis, exacerbationes et remissiones, etiam quotidie, satis manifestas observavi."

the typhus fever of England bears the same relation to the intermittents, dysenteries, &c. which arise together with it, under the operation of the same circumstances, that the remittent fever of southern regions bears to the intermittents, dysenteries, &c. arising together with it, under the operation of the very same circumstances ; and, as the intermittents, dysenteries, &c. of England, are the same diseases with the intermittents, dysenteries, &c. of those southern regions, differing only in grade, it is also evident, that the remittent fever of that country, typhus, is the same disease with the remittent fever of those regions, differing only in grade.

1063. Typhus fever is therefore the autumnal remittent, or bilious fever of England.

1064. This conclusion (1061 to 1063), is supported by a variety of considerations.

1065. The argument of Cullen, that remittents and intermittents are the same disease, because they arise from the same origin, prevail together in the same places, and at the same time of the year, and are convertible into one another (647) ; is equally strong in favour of the identity of typhus fever and intermittents, these also arising from the same origin, prevailing together in the same places and times, and being convertible into one another.

1066. Epidemics manifestly miasmatic are called typhus.

Cullen, in his Nosology, classes under the head of typhus, diseases which, from the situation in which they appeared, and the names given by authors, as descriptive of them, evidently were miasmatic diseases ;

such as the epidemic fevers of Egypt, of Senegal, of Hungary, of Trent, of Cologne, of Warsaw, of Leipsic, of Cremona, of Petersburg, of Silesia, of Vienna, of Dijon, of Presburg, of Modena, &c. These places are all so situated as to make it evident that they are liable to be afflicted with miasmatic diseases. Some of them are notorious for these, as Egypt, Senegal, Hungary, and Silesia. The towns mentioned are situated on rivers; Trent, in a fertile valley on the river Adige; Cologne, in the territory of Cologne, in the circle of the lower Rhine, is situated on the river Rhine, and surrounded by three large ditches; Warsaw, in a plain on the banks of the Vistula; Leipsic, between the rivers Saale and Muld, near the confluence of the Playsse, the Elster, and the Barde; Cremona, on the Po; Petersburg, on the Neva, in the midst of swamps, and built on piles; Vienna, at the confluence of the Vien and the Danube; Dijon, between two small rivers; Presburg, on the Danube, in Lower Hungary (521); Modena, between the rivers Secchia and Panaro in Italy.

1067. The same author mentions, under the head of typhus, the putrid fever of Macbride, the putrid catarrhal fever of 1768, the putrid bilious fever of 1769, and the putrid nervous fever of 1770, described by De Mertens.

There is no question but these terms putrid and bilious were formerly both used to designate the autumnal fevers of low countries. Pringle, speaking of these fevers, says, "The bilious disorders begin about the decline of summer, and become epidemic in autumn, appearing earlier, more general, and with worse



symptoms, in proportion to the heat of the season, and to the moisture of the ground and climate.”<sup>1</sup> “These fevers have been long called putrid,” &c. “They have still more anciently been distinguished by the name bilious,”<sup>2</sup> &c. “If the more general diseases of an army are not to be defined by the seasons, but by the state of the body that accompanies them, we may divide them into the inflammatory, and the bilious or putrid,”<sup>3</sup> &c.

1068. Lind gives an account, from the journal of a surgeon who sailed up some of the rivers of Guinea, of a fever which prevailed in the month of June in a town in 12 degrees north latitude. “Their sickness could not be well characterized by any denomination commonly applied to fevers; it however approached nearest to what is called a nervous fever (typhus, 801), as the pulse was always low, and the brain and nerves seemed principally affected.”<sup>4</sup>

Cullen has also placed under the head of typhus, a fever called *Febris Senegallensis*, and refers to the London Medical Observations, II. 21, for an account of it. He therefore concurs with the surgeon above mentioned, in considering the fever of the West Coast of Africa a typhus. Lind himself calls it a low malignant fever.<sup>5</sup> This fever however occurs only in the rainy season, is of the remitting kind,<sup>5</sup> and besides delirium, coma, sunk pulse, and a train of nervous symptoms, is accompanied by bilious vomitings and purgings, and yellowness of the skin.<sup>4</sup>

It therefore originated amidst abundance of mias-

<sup>1</sup> Pringle on the Diseases of the Army, p. 168.    <sup>2</sup> Ibid. p. 186.

<sup>3</sup> Ibid. p. 73.    <sup>4</sup> Lind on Hot Climates, p. 49.    <sup>5</sup> Ibid. p. 42.

mata, and had the symptoms observed in fevers produced by that remote cause; and was therefore the ordinary miasmatic fever of that country.

Cullen himself has placed the same fever under the head of tertians also, viz. *Febris remittens regionum calidarum*.

1069. Lind gives an account of an epidemic fever which prevailed in the hot summer of 1765, at Portsmouth, and in other parts of England. He says, "During the months of May, June, and July, we had seldom fewer at Haslar hospital than thirty or forty patients, labouring under regular tertian agues, with perfect intermissions. Of these, some were seized *on board the guard-ships* that lay in the harbour near the mud, but the greatest number were marines, who did duty at Portsmouth. In the month of August, the quicksilver in Fahrenheit's thermometer often rose to 82 degrees in the middle of the day. This heat, together with the want of refreshing rains, spread the fever, increased its violence, and in many places changed its form. At Portsmouth, and throughout almost the whole island of Portsea, an alarming continual, or remitting fever, raged, which extended itself even as far as Chichester."<sup>1</sup>

"The marines, who were three times a week exercised early in the morning on South-sea beach, from the effect of the stagnant water of an adjoining morass, suffered much." In some cases there was no perceptible remission for several days. A few vomited bile; in all, the countenance was yellow.<sup>2</sup>

"This may suffice for a brief description of the au-

<sup>1</sup>Lind on Hot Climates, p. 16.

<sup>2</sup>Ibid. p. 17.

*tumnal fever* of Great Britain, which in its utmost violence prevailed in 1765,"<sup>1</sup> &c.

1070. In the hot summer of 1794 the thermometer also stood at 80 degrees, even in the end of June. The French prisoners and their guard at Portsmouth, suffered severely from a fever which prevailed till towards the end of October. Trotter says that yellowness of the skin was particularly remarked among the seamen in that warm summer.

1071. The fever in the hot summer and autumn of 1765, at Portsmouth, was attributed to marsh miasmata by Lind, and called *the autumnal fever* of England. The fever in the hot summer and autumn of 1794, at the same place, is called by Trotter typhus fever; yellowness of the skin being very common in the former, and particularly remarked among the seamen in the latter.

1072. European physicians who settle in this country, and those natives who were educated in England and Scotland, as well as some who studied with both these classes of physicians, frequently call our autumnal fevers typhus: instances of this have come within my own knowledge, and are to be met with in the writings of the physicians of this country.

Thus, in the Medical Repository of New-York, we have an account of a fever called typhus, which was manifestly produced by miasmata. "In the summer of 1798, many towns in the country adjacent to Dartmouth college were visited by a typhus fever, of a type different from any thing heretofore seen in that part of New-Hampshire and Vermont."<sup>2</sup> This fever com-

<sup>1</sup> Lind on Hot Climates, p. 18.    <sup>2</sup> Medical Repository, Vol. 3, p. 5.

menced in Hanover about the last of June, after a spring uncommonly late and wet, and a summer as remarkably hot and dry. By this coincidence the low meadow adjoining the town was kept in a wet state until the weather became excessively hot, and all the circumstances were remarkably favourable to the production of miasmata (215).

In this account, not only is this miasmatic fever called typhus, but the language indicates that this is the ordinary fever of the country.

Some of the physicians of Philadelphia, in 1793, many of whom received their education in Britain, considered the fever of that year as jail fever (or typhus, 801), and treated it as such.<sup>1</sup>

1073. Cullen arranges the different cases of the same epidemic under the different heads of tertian, and synochus or typhus fevers.

1074. Sydenham, in describing "the epidemic constitution of the years 1661, 1662, 1663, 1664, at London," says, that a bad kind of tertian, accompanied by a few quartans, was very prevalent, until the first coming on of winter, and was followed by a continued fever which prevailed till the spring.

1075. These two forms of fever Cullen has arranged under different sections; viz. the tertians, under the section *Intermittentes*, and genus *Tertiana*, by the name *Febres Autumnales incipientes*, &c.; the continued fever, under the section *Continuæ*, and genus *Synochus*, by the name *Febris depuratoria*, &c. They are, however, as entirely the same epidemic, as the different cases of continued, or more properly remittent (1061),

<sup>1</sup> Rush's Works, Vol. 3, p. 95.

and intermittent fever, which occur together in our epidemics, are the same in origin and nature. This is evident from what Sydenham himself says of them.

1076. Sydenham calls these intermittents a bad kind of tertian, in which "the fit was more severe (than in common intermittents); the tongue was more black and dry; the intermission between the fits not so manifest; the loss of strength and appetite greater; a greater tendency to a double fit; all the concomitants, in short, more violent;" &c.

They differed from the continued fever "*only in this*, that *they* happened at stated times, but *this* without intermission; for they both seized almost in the same manner, and those that were violently attacked with either, had a vomiting, dryness of the external parts, thirst, and blackness of the tongue: sweats, also, towards the end of the distemper, readily discharged the morbid matter in both cases. And it may even from hence appear that this fever belonged to the class of autumnal intermittents,"<sup>1</sup> &c.

1077. The continued fever moreover prevailed together with the tertian. Sydenham speaks of this "continued fever attending intermittents."<sup>2</sup> Again he says, "It must likewise be noted, that it is a difficult matter at the first appearance of intermittents, especially of those that are epidemic in autumn, to *distinguish them exactly*; because, at this time, *they are accompanied with a continued fever*; and for some time afterwards, unless great attention be given, nothing more than a remission can be discovered; but *by degrees they perfectly intermit*, and put on a form

<sup>1</sup> Sydenham's Works, p. 13.

<sup>2</sup> Ibid., p. 15.



*entirely* agreeable to the season of the year.”<sup>1</sup> On the other hand, if, in the intermittent form, “heating medicines be given sooner, (than the declension of the disease,) they either double the fit or change the disease into a *continued fever*.”<sup>2</sup>

1078. There needs no effort to convince all that have attended to the course of our autumnal fevers, that this description suits them as well as it did the autumnal fevers of England of 1661 to 1664. We have in every autumn fevers of both types arising *together*, under the influence of the same remote cause; there is often the same difficulty in distinguishing them in the beginning, and those who use the bark are familiar with the expression of *waiting for an intermission*; and there is also the same danger of changing, by heating medicines, the intermittent form into the continued.

1079. It is evident, therefore, that Cullen has made two epidemics of one, by arranging the different cases which occurred in the same epidemic under two different heads, viz. those which had an intermission, under the head of tertians, and those which had not, under that of typhus.

1080. He has done the same in several other instances. He has placed the Hungary fever under both heads, tertian and typhus; under the former, by the name of Morbus Hungaricus; under the latter, by the name of Febris Hungarica sive castrensis.

1081. He has in like manner arranged under the head

Of Intermittents, Tertiana maligna pestilens Riverii;

<sup>1</sup> Sydenham's Works, p. 55.

<sup>2</sup> Ibid. p. 65.

Of Typhus, Febris maligna pestilens Riverii :

Of Intermittents, Tertiana pestilens, P. Sal. Diversus de Febre pestilenti ;

Of Typhus, Febris pestilens, P. Sal. Diversus de Febre pestilenti :

Of Intermittents, Febres pestilentes Egyptiorum, Alpinus de Med. Egypt. ;

Of Typhus, Febris pestilens Egyptiorum, Alpinus de Med. Egypt.

1082. English physicians of the most extensive experience, although they believe typhus fever to be propagated by contagion, have yet traced typhus and and miasmatic diseases to a common origin.

1083. Pringle speaks of the jail fever, or typhus fever, as propagated by contagion, and describes it and the marsh fever as different diseases ; but still traces them to the same origin.

Speaking of the jail or hospital-fever, (or typhus, 801), he says, "The hospitals of an army, when crowded with sick, or when the distempers are of a putrid nature, or at any time when the air is confined, especially in hot weather, produce *a fever of a malignant kind*, and very mortal :"<sup>1</sup> and for instances he refers to the worst cases of the autumnal fever, occurring in different hospitals in the midst of marshes in Holland and Germany.

1084. He says, "Many of the remittents degenerated into continued fevers, which were often fatal ; and the intermittents by being stopped before the proper evacuations were made, or not secured against relapses, changed likewise into continued fevers, or ended in

<sup>1</sup> Pringle on the Diseases of the Army, p. 287.

dangerous obstructions of the viscera.”<sup>1</sup> “But that which was most alarming, was a fever of a malignant nature, slow in its course, attended with a sunk pulse and a constant stupor,” &c. “This fever was confined to the hospital,”<sup>2</sup> &c.

He states that at the village of Feckenheim, there were, besides the wounded, about fifteen hundred sick, most of them with dysentery; and that the jail or hospital-fever appeared also.<sup>3</sup> Speaking again of this place, he says, “There the hospital-fever and dysentery grew worse and worse. Few escaped; for however mild or bad the flux was, for which the person was sent to the hospital, this fever almost surely supervened. The petechial spots, blotches, parotids, &c. sufficiently showed its pestilential nature.”<sup>4</sup>

The sick were ordered to be removed from Germany to Flanders in boats. “During this voyage, the fever (of the hospitals, that is the typhus fever, 801) having acquired new force by the confinement of the air, by the mortifications, and *other putrid effluvia*, it became so virulent that above half the number died *in the boats*.”<sup>5</sup>

“This fever (the autumnal epidemic,) generally remitted from the beginning, especially upon bleeding, and evacuations of the primæ viæ; but if these precautions were omitted, the disease went on in almost a continued form. Such was the tendency to putrefaction, that some had spots and blotches, and even mortifications almost always fatal. With these and such other symptoms most of the cases were accompanied, during

<sup>1</sup> Pringle on the Diseases of the Army, p. 14.      <sup>2</sup> Ibid. p. 15.

<sup>3</sup> Ibid. p. 22.

<sup>4</sup> Ibid. p. 25.

<sup>5</sup> Ibid. p. 26.

the first rage of the distemper, in the cantonment next to the inundations." "Thus, though the sickness was general, those who were near the marshes suffered by far the most, both in number and violence of the symptoms."<sup>1</sup>

Speaking of the same, he says, "This fever is often fatal to an army, when so many are seized at once as cannot be properly attended; or, *when it changes into a continued or malignant form, either by neglect at first, or by crowding too many who are ill of it into the same hospital.*"<sup>2</sup>

Again, he says, "These *marsh fevers* are not only apt to begin with little remission, but after intermitting for some days, to change again into *continual fevers* of a putrid and malignant nature."<sup>3</sup> "At the height of the epidemic, it appeared that both intermittents and remittents, by extending or doubling their paroxysms, frequently changed into a continued, putrid, and dangerous form, and that most of those whom we lost died in this way. These men, as we remarked, had a corrupted smell for a day or two before their death, and soon after it their bodies mortified. Some had petechial spots, *though the place where they lay was neither crowded with sick, nor too close; and to these spots were added some other symptoms, the same with those of the hospital-fever.*"<sup>4</sup>

1085. In the chapter on jail fever, he further says he has observed the same kind, as that which he has mentioned and referred to as arising in hospitals in marshy situations, arise in full and crowded barracks, trans-

<sup>1</sup> Pringle on the Diseases of the Army, p. 65.

<sup>2</sup> Ibid. p. 172.

<sup>3</sup> Ibid. p. 173.

<sup>4</sup> Ibid. p. 181.

port-ships, and hospital-ships ; and says it is the same fever called in England jail fever ; and, afterwards, goes the full length of attributing the latter to the same cause which produces the autumnal bilious remittent.

“The malignant or pestilential fevers are various, &c. but all seem to depend upon some internal or external forms of corruption, whether owing to a putrid habit, or to *exhalations from corrupted animal or vegetable substances.*”<sup>1</sup> After mentioning cases of malignant fever produced by putrefaction of vegetables and of marshes, he says, “I might adduce many instances of malignant fevers, *occasioned by the putrid effluvia of marshes*, from other authors ; but as those already mentioned are sufficient to prove what has been advanced, I shall observe upon the whole, that the bilious or remitting and intermitting fevers of low and wet countries, when at the worst, may be considered as a species of the malignant or pestilential fever, since they have been seen with all the virulent symptoms peculiar to that class of diseases.”<sup>2</sup>

1086. “From this view of *the causes of malignant fevers* (typhus 1085), and fluxes, it is easy to conceive how incident they must be, not only to *all marshy countries after hot seasons*, but to all populous cities low and ill aired, unprovided with common sewers ; or where the streets are narrow and foul ; or the houses dirty,”<sup>2</sup> &c.

“In general it may be remarked, that the putrefaction of animal or vegetable substances, *in a dry air*, is most apt to produce a malignant fever of a more continued form ; whereas, putrid effluvia, *in a moist at-*

<sup>1</sup> Pringle on the Diseases of the Army, p. 320.

<sup>2</sup> Ibid. p. 323.



*mosphere*, have a greater tendency to bring paroxysms and remissions.”<sup>1</sup>

1087. Here the sameness of the origin of the typhus and of miasmatic fevers is clearly admitted: indeed we might as well call the worst cases of our epidemics, which occur in the more crowded parts of the towns, in the confined habitations of the poor, a different fever from the milder cases, which occur in more favourable circumstances, as call the fever in the crowded hospitals in the marshes of Holland, a different fever from the milder marsh fever in less crowded situations.

1088. Trotter also, although he seems to have embraced the doctrine of the contagious nature of typhus fever without questioning its truth, is led, by the force of numerous facts which came under his own observation (1055), to the conclusion that this fever and miasmatic diseases have a common origin. He mentions this subject in several places,<sup>2</sup> which shows his attention had been forcibly arrested by the frequency of the appearance of these diseases in company, and their being converted into one another (1055, particularly the last paragraph): and he at length comes to the conclusion, that dysentery and tertian fever are produced by the supposed contagion of typhus fever.<sup>2</sup> His words are, “We have now seen in the *Vengeance*, the contagion of typhus, brought on board by two men, extend throughout a ship’s company: and in the space of four months, in different subjects, produce continued, remittent, and intermittent forms of fever. In Lord Moira’s transports,

<sup>1</sup> Pringle on the Diseases of the Army, p. 324.

<sup>2</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 192. 312. 313.

something of the same kind occurred, with the addition of dysentery. To these I might add other facts in confirmation, from almost every ship which I have attended under a general contagion."

"These numerous facts undoubtedly prove a common origin; but as tertians, &c. are known to be miasmatic diseases, the conclusion is inevitable that typhus fever also is produced by miasmata.

1089. Blane draws another erroneous conclusion. Observing the yellow fever arise in the same circumstances which, in northern regions, give rise to typhus fever; he very justly attributes the former to the same cause with the latter, but calls it Typhus Icterodes, considering it a typhus fever, and distinguishing it from the yellow fever produced by miasmata.

He says that the fevers which arise in the West Indies from exhalations from the soil, similar to those produced by the same cause in other countries, are there attended by the peculiar symptom of yellowness of the skin; that the sporadic fevers from intemperance, fatigue, &c. have the same peculiarity; but that these are not the contagious yellow fever. This disease, the typhus icterodes, is produced by the "foul air engendered on board of ships on long voyages, in circumstances of personal filth and want of ventilation, frequently combined with hardships and privations, and is the same with those stagnated and corrupted effluvia of the living human body which produce typhus fever."<sup>1</sup>

1090. We agree, as before, that the cause of the typhus and of the yellow fever are one. But the yellow fever has been already shown to be produced by

<sup>1</sup> Blane's Medical Logic, p. 248.

miasmata, and we know that miasmata exist on board of ships in the circumstances he mentions. Therefore, the origin of both being the same, typhus fever must be the effect of miasmata.

1091. Blane, indeed, attempts to make a distinction between the yellow fever produced by miasmata, and that produced on shipboard. He is driven to this by his views of the origin of typhus. The two diseases being produced by the same remote cause, and he being fully persuaded that typhus fever is produced by contagion, concludes, and endeavours to show, that the yellow fever generated on board of ships, is different from that produced by miasmata. But the attempt is vain.

1. Because it is manifest, from the circumstances which occur on board of crowded ships, that miasmata must be produced (168 to 175. 988. 989).

2. Because the occurrence of miasmatic diseases of every form and grade on board of ships, together with the yellow fever (744), shows plainly the presence of miasmata in such circumstances.

3. Because the yellow fever produced in such circumstances is not distinguishable from the yellow fever acknowledged by Blane to be produced by miasmata. The physicians of the United States and of the West Indies, have not adverted to such a distinction. They consider the disease as the same, whether it arise on shipboard or on shore. The physicians from those islands, who came to this country in 1793, recognized the yellow fever of our cities as the same disease with that prevailing among the shipping in the West Indies ; and Blane himself says that the fever of

Grenada was the same with that of Philadelphia and other seaports of the United States; alleging it was brought over by emigrants from St. Domingo and other islands.<sup>1</sup>

1092. If therefore we consider the weight of evidence arising from the consideration of typhus fever and fevers acknowledged to be miasmatic appearing in the same situations and seasons, of the same kind of weather being favourable to the prevalence of both, of the symptoms being the same, of their being convertible into one another (1060), of epidemics manifestly miasmatic being called typhus by a distinguished nosologist, and by others (1066 to 1072), of the distinction made between the different cases of the same epidemic (1073 to 1081), whereby every one may be divided into two (1075), of the admission of a common origin of typhus and miasmatic fevers by English physicians of the most extensive opportunities for observation (1082, &c.), there cannot remain a rational doubt of the truth of the doctrine, that typhus fever is produced by miasmata (940).

<sup>1</sup> Blane's Medical Logic, p. 251.

## CHAPTER XIII.

### IDENTITY OF AUTUMNAL REMITTENTS, TYPHUS FEVER, AND PLAGUE.

1093. It has been shown that both typhus fever and the plague originate in miasmata, and the identity of each with the autumnal remittent fever, has also been shown. A few observations will now be made respecting the identity of all these fevers, which could not properly be made sooner.

1094. The common autumnal remittent of Holland, in hot summers, and particularly near inundations and marshes, assumes the continued form, "with spots, blotches, and mortifications."<sup>1</sup>

1095. "At Copenhagen, in the year 1652, a fever began in autumn after an unusually hot and dry summer. That city is situated in a low and moist country." This fever was accompanied by quotidian or tertian paroxysms, bilious vomitings, &c. and with petechiæ and abscesses, and was called a malignant fever.<sup>2</sup>

1096. "In the year 1669, a like fever raged at Leyden;" the situation of which place is low and damp. The summer and autumn were unusually hot, dry, and calm. "The water of the canals and ditches was highly corrupted." The fever was of a remitting or

<sup>1</sup> Pringle on the Diseases of the Army, p. 65. 181.    <sup>2</sup> Ibid. p. 189.



intermitting form, with bilious vomitings, spots, oozing of blood from the nose and hemorrhoidal veins, and apthæ.<sup>1</sup>

1097. These fevers are still more frequent and violent “in the marshy countries of the south, where the heats are longer and more intense. In some parts of Italy, and in other tracts of the same latitude, these fevers have appeared with such dangerous and putrid symptoms, as not only to have been called pestilential, but confounded with the plague itself.”<sup>2</sup>

1098. Hippocrates frequently mentions such “fevers as common in summer and autumn, and as prevailing most when wet springs with southerly winds were succeeded by hot and close summers. A remarkable constitution of this kind is described in his *Epidemics*, at which time the diseases were ardent, remitting, and intermitting fevers of a bad kind, attended with fluxes, parotids, and eruptions of a pestilential nature.”<sup>3</sup>

1099. Prosper Alpinus says that pestilential fevers, with great nausea, and vomiting and purging of bile, are epidemic and fatal at Alexandria in autumn after the recess of the Nile (469); and that the stagnating canals in Cairo produce the same every year, in March, April, and May, “which the southerly winds make the hottest months in that country.” “Now,” says Pringle, “as these distempers rage in both those cities every year, it is not surprising, if, in seasons uncommonly hot and moist, they should be raised to a true plague. For, though the learned author asserts, that the true plague

<sup>1</sup> Pringle on the Diseases of the Army, p. 190. 191.

<sup>2</sup> Ibid. p. 191.

<sup>3</sup> Ibid. p. 193.

is not properly indigenous in *Egypt*, but is brought thither from *Greece*, *Syria*, or the more southern parts of *Africa*, yet he thinks that it may sometimes begin there *after extraordinary inundations of the Nile*, when the water, extending itself beyond the usual drains, stagnates, and forms some large putrid marshes.”<sup>1</sup>

1100. The fever originating in the hospitals amidst the marshes of Holland (1094), is called by Pringle hospital or jail fever (typhus 801), and mentioned as “a fever of a malignant kind, and very mortal”<sup>2</sup> (1085. 1086).

1101. This fever was accompanied by petechial spots, blotches, parotids, and frequent mortifications;<sup>3</sup> and sometimes by “suppurations of the parotid, or axillary glands.”<sup>4</sup> His description of the “eruptions” strikingly corresponds with that of the eruptions in the plague (924). “There is a certain eruption, which is the frequent, but not inseparable attendant of the fever. This is a petechial efflorescence, that is sometimes of a brighter, or paler red, at other times of a livid colour, but never rises above the skin.” “The nearer they approach to a purple, the more they are to be dreaded. In a few cases, instead of spots, I have observed purple streaks and blotches, which perhaps are still a worse symptom. The petechiæ will sometimes not appear till after death,”<sup>5</sup> &c. (914).

1102. Pringle, we have seen, alleges that the autumnal remittent and hospital fever, jail fever, or typhus, are different diseases, and yet shows that their

<sup>1</sup> Pringle on the Diseases of the Army, p. 193. 194.    <sup>2</sup> Ibid. p. 287.

<sup>3</sup> Ibid. p. 25. 65.

<sup>4</sup> Ibid. p. 298. 313.

<sup>5</sup> Ibid. 296. 297.

origin is the same (1086), as well as the symptoms (1094 to 1101); so likewise, although he alleges there is a difference between the hospital fever and the plague, he asserts they have a similar cause and like symptoms. He says, "though the hospital fever may differ *in specie* from the true plague, yet it may be accounted of the same *genus*; since it seems to proceed from a similar cause (1099), and is attended with the like symptoms"<sup>1</sup> (1101).

1103. It is evident from this account, that the autumnal remittent fevers in very hot, dry, and calm summers in marshy countries (1094), pass into that grade of epidemic disease that has been called pestilential; and the pestilential, in circumstances uncommonly favourable to the production of epidemic disease, into the plague, as admitted by Prosper Alpinus (1099). An expression of Diemerbroek's conveys a similar idea. The spotted fever prevailed in 1635 at Nimeguen, and it continued to become more malignant, "*donec in apertissimam pestem transiret,*" until it passed into, or increased into the most undisguised plague.<sup>2</sup>

1104. This increase of the symptoms of the prevailing fever until it became an undisguised plague, is evident from Sydenham's and Morton's account of the plague in London, in 1665 (932 to 937). Sydenham would not positively affirm that the fever in the forepart of the summer and the plague were the same; but says he knew by experience that they had the same symptoms (933). Morton speaks more positively, and

<sup>1</sup> Pringle on the Diseases of the Army, p. 320.

<sup>2</sup> Webster, History of Pestilence, Vol. 1, p. 184.

says, that the autumnal fevers (he calls them synochas,) when not properly treated, degenerated into malignant and fatal fevers, and sometimes from the beginning were distinguished by all the symptoms of the plague (937).

1105. The identity of these diseases is further shown by the fact, that disputes frequently arose concerning the real nature of an epidemic (930. 931). An autumnal disease becoming violent was called pestilential; the symptoms by degrees becoming more and more malignant, some at length called the fever plague; others denied, and the dispute was frequently settled, not by any distinguishing symptoms that could with confidence be referred to, but by reference *to the origin* of the fever. If it could be shown to arise from some local cause, as it was not admitted by any people that the plague originated *with them*, it followed that the disease was not the plague. Thus, "in the year 1694, a fever broke out at Rochfort in France, which on account of the malignant symptoms and great mortality, was believed to be the true plague." But when the disease was found to have arisen from some marshes, over which the wind "had long blown" on the town, the idea of its being the plague was abandoned.<sup>1</sup>

1106. These diseases, therefore, originating in the same situations and seasons, and passing insensibly into one another, so that disputes continually occur respecting the name of the disease, not only in the commencement, but in the progress and decline, are evidently one and the same disease, differing only in grade.

<sup>1</sup> Pringle on the Diseases of the Army, p. 323.

## CHAPTER XIV.

### UNITY OF FEVER.

1107. Typhus fever originating in miasmata (1060), and being a remittent fever (1061), the distinction between continual and intermittent fevers does not exist in nature, and there is but one fever; a truth long since proclaimed by Rush.

1108. Cullen has three genera of continual fevers. His two first are Synocha and Typhus. In synocha the pulse is strong, frequent, and hard, and the heat much increased;<sup>1</sup> in typhus, the pulse small, weak, and for the most part frequent, and the heat little increased, with disturbance of the functions of the mind.<sup>2</sup> But seeing that a fever is not always in its whole course either one or the other, and therefore cannot be referred to either, he has *inserted* a genus,<sup>3</sup> Synochus, under which he arranges all fevers which in the beginning were synocha, in progress, and towards the end typhus.<sup>4</sup>

<sup>1</sup> Synocha. Calor plurimum auctus; pulsus frequens, validus, et durus; urina rubra; sensorii functiones parum turbatae.

<sup>2</sup> Typhus. Morbus contagiosus. Calor parum auctus; pulsus parvus, debilis, plerumque frequens; urina parum mutata; sensorii functiones plurimum turbatae; vires multum imminutae.

<sup>3</sup> Cum plures febres nec inflammatoriae nec nervosae ex omni parte sint, neque idcirco vel ad Synocham vel ad Typhum facile referendae; genus Synochi, cujus typus hisce regionibus frequens conspicitur, hic inserui. Synop. Nosol. Cullen, Tom. II. p. 78.

<sup>4</sup> Synochus. Morbus contagiosus. Febris ex synocha et typho composita, initio synocha, progressu et versus finem typhus.



1109. It is to be observed, that the very fact of the synocha becoming typhus shows their identity ; as a remittent becoming an intermittent shows the identity of these. It is evident that in a synocha continuing a considerable time and ending in death, the vigour of the system must gradually yield, and the pulse become small and weak, and the powers of the mind be disturbed. In this state the disease according to the definition has become typhus ; but the patient surely has not a different disease ; it is the same he had from the beginning ; it is the synocha which has reduced him to this low condition ; the change is in him ; and the difference in him is, that his heart is no longer capable of the same vigorous action that was observed in the beginning. Thus Morton, speaking of Cromwell's case and his father's, expresses himself in the following manner : " The synocha, in both cases, *as the powers of nature gave out*, turning to synochus, with delirium, spasms, and other symptoms of high malignity."

1110. It is further to be observed, that this change depends on the treatment. The malignant symptoms appear in bad cases if proper evacuations are neglected (1044. 1084) ; and almost never if they are employed. After their appearance, proper evacuations produce surprising benefit.

The change depending on the treatment, the difference is an accidental, not an essential one.

1111. In order to determine to which genus a given case of fever belongs, synochus having no symptoms of its own, the first question is, are the symptoms those

<sup>1</sup> Morton's Summary, &c. Medical Repository, Vol. 1, p. 51.

of synocha, or those of typhus? In either case, there is a second question.

1112. If the fever be synocha, the question is, will it continue so, or end in typhus? If it continue so, the fever is synocha; if it end in typhus, the fever is synochus. But the appearance of the symptoms of typhus depending on the treatment (1110), whether they appear or not is accidental. A difference depending on an accidental circumstance, is not an *essential*, and therefore cannot constitute a *generic* difference. A synocha, therefore, which ends in typhus, and one which does not, do not belong to different genera; or Synocha and Synochus are one and the same.

1113. If the fever be typhus, the other question (1111) is, has it been so throughout, or was it in the beginning synocha? If not synocha at first, the disease is typhus. As the question, was the disease in the beginning synocha or not? rests on the point whether the pulse was strong, hard, and frequent, or not, the only doubt that can exist on the subject is, whether the pulse was sufficiently strong, hard, and frequent, to entitle the disease to be called synocha. If so, it is synochus; if not, typhus. The question whether the disease is synochus or typhus, rests therefore on the degree of the strength, &c. of the pulse, which is not a generic difference. Indeed, as grades of strength, &c. are infinite in number, if difference of grade constitute generic difference, there are an infinite number of genera. There is therefore no generic difference between Synochus and Typhus. Cullen himself acknowledges he cannot accurately distinguish between them, and is doubtful whether they ought to be consi-

dered different; and to which of the two, if they are made different, to refer the synonymes of authors.<sup>1</sup>

1114. We have before seen (1112) that between synocha and synochus, there is no difference; and now that between synochus and typhus there is none. Therefore there is none between synocha and typhus; and all three are one and the same.

1115. The British writers seem to have fallen into this view of the subject. Currie calls typhus the common fever of England, the epidemic of all the great towns, &c. (801); and in the list of diseases at the Liverpool Infirmary (942) he mentions the number of *fevers* in one place, and the same number under the head of *typhus fever* in another place, both for the month of September 1790, indicating that all the fevers were typhus. Trotter speaks of typhus, times without number, in his *Medicina Nautica*; but never, I think, of synocha or synochus. On the contrary, in the report of the surgeon of the *Uranie* it is said, that the fever (typhus) had two kinds of attack, differing perhaps on account of the constitution of the patient. In the one, the pulse was *hard*, &c. (1032). Trotter makes no objection to this, although he is in the habit of making observations freely on the reports presented to him. This clearly indicates that he habitually

<sup>1</sup> Inter Typhum tamen et Synochum limites accuratos ponere non possum; et an re vera pro diversis generibus habenda, vel, positis diversis, utri eorum Synonyma auctorum referenda sunt, dubito. Synop. Nosol. Cullen, Tom. II, p. 79.

Nevertheless I cannot state the exact limits between Typhus and Synochus; and indeed I doubt whether they are to be considered different genera, or, being reckoned different, to which of them the Synonymes of authors are to be referred.

confounded what Cullen calls synocha and synochus, with typhus.

1116. Not only is there no foundation for the different genera of continued fever, but there is none for the distinction between continued and intermittent fevers.

1117. Sydenham says that the intermittent fevers of London, of 1661, &c. were converted into continued fevers by the use of heating medicines, if given before the declension of the disease.<sup>1</sup> The former Cullen classes with intermittents; the latter, with synochus. Morton says the continued changed into the intermittent form. He says, "The continued fever with which I was first affected, turning into a quotidian, and then into a tertian intermittent,"<sup>2</sup> &c. Pringle says that in hot summers the autumnal intermittents in Holland became continued fevers, particularly when proper evacuations were not used.<sup>3</sup> Here then intermittents become continued; and continued, intermittent.

1118. Cullen's argument for the identity of remittent and intermittent fevers (647), is therefore equally applicable here; and continued or remittent and intermittent fevers are the same disease. There is therefore but one fever.

<sup>1</sup> Sydenham's Works, p. 65. <sup>2</sup> Medical Repository, Vol. 1, p. 51.

<sup>3</sup> Pringle on the Diseases of the Army, p. 14.

## CHAPTER XV.

### OF A GENERAL EPIDEMIC CONSTITUTION OF THE ATMOSPHERE, CONSIDERED AS A REMOTE CAUSE OF FEVER.

1119. Epidemics have also been attributed to a general epidemic constitution of the atmosphere. Sydenham's writings are full of this doctrine, but he doubts whether a pestilential constitution of the air be alone sufficient.<sup>1</sup> Physicians in succeeding times have had recourse to the same mode of accounting for the prevalence of epidemics; and to this day, although the doctrine of the dependance of epidemics on miasmata rests on evidence too strong to be shaken, there is a disposition to attribute them to a secret or unknown constitution of the atmosphere, at least so far as may be necessary to explain the occurrence of epidemics in circumstances in which it is supposed that miasmata cannot be present.

1120. This doctrine is frequently mentioned in the Medical Journals of this country, and is supported at some length in a paper published in the Philadelphia Journal of the Medical and Physical Sciences.

1121. It is there said, the epidemic of 1822 "is ascribed by some to excessive heat; by others, to the combined influence of heat and a superabundance of rain; by a third class, to heat and a long continued

<sup>1</sup> Sydenham's Works, p. 77.



drought; and by a fourth, to the influence of certain topographical situations, because in those situations the complaint has proved unusually severe.”<sup>1</sup>

1122. In opposition to this it is contended that epidemics, as to mere existence, are “independent of all local and perceptible causes, a certain degree of temperature alone excepted;” and that they are produced by “a general epidemic constitution of the atmosphere.”<sup>2</sup>

1123. In support of this doctrine, it is alleged that the epidemic of 1822 prevailed in almost every section of the United States; but that in relation to the sensible qualities of the atmosphere, a very striking variety and even contrast prevailed in different sections; and that, “in point of topographical position, many places equally sickly are perfectly dissimilar.”<sup>1</sup>

1124. In particular, it is alleged that “in Pennsylvania, Maryland, and some parts of Virginia, the temperature of the summer has been moderate, and the drought unprecedented, yet there the epidemic has prevailed.

“In the Carolinas and Ohio, there has been nothing peculiarly remarkable in the season, heats and rains having been in their ordinary proportion, yet *there*, in like manner, the disease has been prevalent.

“Kentucky has been inundated by rains, and the season has been hot, and *there* we have also had to encounter the epidemic.

“Louisiana, Mississippi, and Alabama, appear to have enjoyed their ordinary season, yet in some parts

<sup>1</sup> Philadelphia Journal, &c. No. 10, p. 314.      <sup>2</sup> Ibid. p. 315.

heretofore found healthy, they have experienced a most fatal epidemic.

“To the condition of things in Indiana, Illinois, and Missouri, similar remarks are equally applicable.”

1125. It is further alleged, that “in some of the Atlantic states, it has been confined almost exclusively to the dry and hilly grounds, the low, flat, and humid tracts of country having for the most part escaped.

“In the states of the West the reverse of this is true; the hills being more healthy, and the low grounds of water courses the theatre of disease. Yet, under all these different circumstances the complaint is the same.”

1126. On these grounds it is concluded, “In relation to its mere existence, then, our epidemic would seem to be independent of all local and perceptible causes, a certain degree of temperature alone excepted. By those causes it is modified, but not created.”

1127. The question is next proposed, “To what cause, then, is its existence to be attributed?” The answer is, “To a general epidemic constitution of the atmosphere.” “What is the nature of this constitution, or whence it is derived, is entirely unknown to us;” but “by looking into the general history of epidemic diseases, we find that in different ages and countries, this atmospheric constitution has occurred at irregular periods, continued an indefinite length of time, and at last disappeared, without disclosing any vestige of the cause of either its rise or its decline.”

1128. It is admitted, however, that “local exhalations from the surface of the earth necessarily co-operated with the constitution of the atmosphere. Without the exhalations the disease could not have existed :

nor could that cause alone have given rise to it. It was the result of the conjoined operation of both.”<sup>1</sup>

1129. However plausible this argument may at first view appear, there is nothing in the situation or circumstances of the countries mentioned, inconsistent with the doctrine contended for in the preceding pages; and nothing to justify the inference that epidemics are “independent of all local and perceptible causes, a certain degree of heat alone excepted.”

1130. It is stated that in Pennsylvania, Maryland, and some parts of Virginia, the temperature of the summer was moderate, and the drought unprecedented, yet there the epidemic prevailed (1124).

1131. This unqualified statement would lead to the belief, that the epidemic was general in these countries. This, however, was not the case. The valley of the Shenandoah in Virginia was generally healthy. The few places which suffered are near marshy grounds, or rivers which in that arid season were almost dried up, leaving extensive flats covered with an abundance of the vegetables which grow in water, exposed to the action of a hot sun. Such are Harpers-Ferry and Shepherdstown (364. 365).

The highlands below the Blue Ridge were likewise healthy, and the parts that suffered were on the borders of the rivers: thus, in the country along the Rapahannock river from Port-Royal to Tappahannock, a considerable extent of country where marshes on the river side abound,<sup>2</sup> this dry summer was unusually sickly.<sup>3</sup>

<sup>1</sup> Philadelphia Journal, &c. No. 10, p. 316.

<sup>2</sup> Ibid. No. 12, p. 277.      <sup>3</sup> Ibid. p. 287.

1132. Of the diseases in Maryland, in 1822, I have no account.

1133. In Pennsylvania, in the neighbourhood of Harrisburg, it rained on eight days in the first half of July; on the fifth there was a good deal of rain. In this month the dysentery prevailed in Hanover, and appeared in Paxton, both east of Paxton-creek; and the fever was increasing along that creek, and the river Susquehannah, and in the town between the two.

From the middle of July to the middle of September there was no rain. In August "the earth had become exhausted of moisture, and the streams were drying up;" in September the earth was "like a brick," and the creeks and rivers were nearly dried up.

This drought checked the autumnal diseases. On the 31st of July the epidemic was extending but not fast; and on the sixth of August was abating considerably, excepting in some valleys, particularly in Fishing-Creek Valley. The town was comparatively healthy in August and September.<sup>1</sup>

1134. The autumnal diseases did not therefore prevail in Virginia and Pennsylvania, except about water-courses; and in the latter, although there was considerable sickness early in the season, there having been some rains in July, nevertheless, weeks before autumnal epidemics in general are at their height, it had considerably abated, and in some places almost disappeared before the middle of August.

1135. It is stated that in Carolina and Ohio there was nothing particularly remarkable in the season, "heats and rains having been in their ordinary pro-

<sup>1</sup> Medical Recorder, No. 21, p. 139, &c. by Dr. Agnew.

portion;" yet *there*, in like manner, the disease has been prevalent (1124).

1136. Of the former I have no information ; but in the latter, the weather was so dry that "the Ohio river was lower than ever known since the settlement of the country. The water was in most places nearly stagnant, resembling a long lake more than a river, and covered with a mucous scum or froth"<sup>1</sup> (244).

The epidemic of this year, so far from prevailing in Ohio, was "wholly confined to the neighbourhood of streams," and it was observed, "that those settlements, located where the shores of the river were bold and not lined with a wide beach, were uniformly healthy, and vice versa"<sup>2</sup> (244).

1137. It is stated that Kentucky was inundated with rains, and the weather was hot, and *there* also the epidemic prevailed (1124). Both parts of this statement are correct (250).

1138. It is stated that in Louisiana, Mississippi, and Alabama, the season was an ordinary one ; and yet in some places, before then healthy, they experienced a most fatal epidemic (1124).

1139. By turning to the account of the epidemic in Mississippi in 1822, it will be found that that season was not an ordinary one ; but just such an excessively wet one, as occurred in Kentucky in the same year, and that the event was precisely the same, a severe epidemic (308).

1140. Of Louisiana I have no information ; but in Alabama, there was a higher flood in the river Alabama than had been known for many years,<sup>3</sup> and there

<sup>1</sup> Philadelphia Journal, &c. No. 17, p. 107.

<sup>2</sup> Ibid. p. 106.

<sup>3</sup> Ibid. No. 18, p. 262.



can be little doubt that in all this flat country, about the lower part of the river Mississippi, the same excessive rains occurred. Of the effect in Alabama in 1822 nothing is said, but the following year, also very wet, was very sickly<sup>1</sup> (313).

1141. Of Indiana, Illinois, and Missouri, nothing specific is stated.

1142. Let us now contrast the effects of this dry year with those of the exceedingly wet year 1823. In the latter the rains were excessive in Pennsylvania, Maryland, Virginia, Ohio, Mississippi, and Alabama; and the autumnal epidemic was very severe in all those states (245. 255. 313. 362).

In particular, it was very sickly in every part of the valley of the Shenandoah, excepting where the river was full and there was no marshy ground. Thus, Harpers-Ferry, which suffered most severely in the year 1822, when the bottom of the river was exposed, in 1823, when the banks were full, was remarkably healthy (363).

In Ohio, the upland and the hilly country, which escaped in the dry season, 1822, suffered excessively in the wet year 1823; the fever prevailed even in some districts of the Alleghany mountain (245).

1143. It is evident, therefore, that in dry seasons health is general, and in wet seasons sickness is general; that the sickly spots in dry times are near streams or marshes; and that when one part of the country is dry and another wet in the same seasons, the dry part is healthy, except about streams and marshes, and the wet part sickly.

<sup>1</sup> Philadelphia Journal, &c. No. 18, p. 263, &c.

1144. It is alleged that in some of the Atlantic states the epidemic was confined to the high and hilly grounds, while the low, flat, and humid lands escaped; and that in the Western states the reverse was observed, the hills being more healthy, and the low grounds on the banks of the rivers being sickly.

1145. Why the hills of the West were healthy, and the low grounds sickly in 1822, we have already seen (244); it was because this hilly country was excessively dry, and the sickness was confined to the marshy spots on the rivers. With regard to the Atlantic states, we know that in this part of them the hilly country was healthy, as in the West, and for the same reason; the country was burnt up. In the valley of the Shenandoah, in 1822, the corn, in August and early in September, was bleached to the roots by the drought (361). On the contrary, in the humid country along the Rappahannock river, in the Northern Neck of Virginia, it was at the same time very sickly (1131).

The hills and the low grounds of the Atlantic states and of the West fared, therefore, alike in this dry year: they did so likewise in the following wet year, 1823. In the latter the hills of the West suffered severely (245); and in this valley the cultivated parts of the western side of the Blue Ridge also suffered (165).

1146. It is evident from the preceding observations, that every case mentioned is in perfect accordance with the doctrine of the dependance of epidemic fevers on the concurrence of heat and moisture in operation on vegetable matter; and that there is not one which supports the doctrine that epidemics are "in-

dependent of all local and perceptible causes, a certain degree of temperature excepted." On the contrary, that rains are indispensably necessary to the production of a general epidemic in these countries; and in the absence of rains the epidemic is limited to the moist spots about the sides of rivers, and, as it were, *located in them* (244. 364. 365. 366). Moreover, as epidemic diseases always prevail where the circumstances are favourable to the production of miasmata, and never where they are not; as they even appear in that particular quarter to which the exhalations from a marshy spot are driven by the wind, and do not appear in other directions (161 to 163); and as they cease when, by draining, by overflowing, or by filling up a marshy place, the source is cut off, the general state of the atmosphere meanwhile continuing the same, it is evident that their appearance depends entirely on the presence of miasmata, and not upon a *general* constitution or state of the atmosphere.

1147. Independently of this argument, the doctrine of the production of epidemic diseases by a general epidemic constitution of the atmosphere, is destroyed by the single fact that the alleged cause is general, the effects partial.

In 1822, Ohio, Pennsylvania, and Virginia, were generally healthy; and Kentucky and Mississippi unhealthy. In the three former states, though they were generally healthy, wet places were very sickly. Shepherdstown and Harpers-Ferry, in Virginia (364. 365), and some situations on the Ohio river (244) suffered most severely.

In 1821, Fairfax county, in Virginia, and almost all

the neighbouring country, far and wide, suffered severely from an epidemic fever. Centreville, however, escaped with only one severe case; there were two, but one was brought from the country (148). In the same season, the upper part of Fauquier county escaped by the destruction of almost every mill-dam, and the consequent drying up of almost every mill-pond in the country (330). A number of similar cases have been stated in the preceding pages.

Effects so partial cannot proceed from a general constitution of the atmosphere.

1148. If to avoid this difficulty, it be alleged that the co-operation of exhalations from the surface of the earth is necessary to give effect to the epidemic constitution of the air, and that the partial effects observed are the consequence of the exhalations being local; it is evident that the admission of the necessity of exhalations to the existence of epidemics, destroys the very foundation on which the existence of the unknown constitution of the atmosphere rests. For if exhalations are necessary, they are always present, and it is on the presumption of *their absence* that the necessity of calling in the aid of a general epidemic constitution of the atmosphere is founded.

1149. The doctrine of the dependance of epidemics on a *general* epidemic constitution of the atmosphere is therefore unfounded (1146. 1148).

1150. This language originated when little attention was paid to the remote causes of disease, and then it was not improper: it was at that time an unknown constitution of the atmosphere which produced epidemics; it is now a known constitution.

1151. The concurrence of heat and moisture in operating on vegetable matter being necessary to the production of epidemics, it is evident that the epidemic constitution of the atmosphere, that is the constitution or state of the atmosphere which produces an epidemic, must vary according to the circumstances of the country.

1152. In warm countries the epidemic constitution of the atmosphere is that state which lets fall abundant rains. Thus, in the United States, but more particularly in the middle, southern, and south-western states, the abundant rains of 1823 produced a general epidemic; those places only being excepted, in which, by the superabundance of water, the vegetable matter was entirely protected from the action of the sun (255. 313. 362. 364.)

1153. In 1822 this constitution was not general. It prevailed in Kentucky, and produced a severe epidemic (250); but in Ohio, in Virginia, in Maryland, and in Pennsylvania it did not, and health was general in those states (244. 361.)

So in 1817 this constitution prevailed in Mississippi, in Louisiana, and in Carolina, and a severe epidemic followed in those states (254. 309. 320). In 1819 the same constitution prevailed, and the same consequence followed in Mississippi, Alabama, and Louisiana (254. 305. 306. 307. 310); while in Kentucky the opposite constitution prevailed; it was very dry, and there was little or no sickness (248). In 1821 the same constitution prevailed in Kentucky, Virginia, and Pennsylvania, and another epidemic was the consequence (249. 330).



1154. The dependance of these epidemics on this constitution of the atmosphere is strikingly shown by the decline of the epidemic in the opposite state of the air; as in Pennsylvania in 1822 (1133); also in 1821 in the upper part of Fauquier in Virginia (330); and in Frederick county in the same state in 1824 (368).

1155. In cool and moist countries, the constitution of the atmosphere which produces epidemics is a high temperature of the air. Thus, in England, generally very moist, a hot summer is sure to produce a general epidemic; as in 1765, and in 1794 (524. 963, &c.).

1156. In countries in which there are deep wet marshes, the constitution necessary to produce epidemics is a very dry as well as hot one. Thus, in Trinidad, and most of the West India islands, where almost all the towns are near marshes, often very deep and wet, in seasons of great drought epidemics prevail. The same is true of the island of Sardinia (525).

1157. No one state of the atmosphere, therefore, is an epidemical constitution in every country, or even in every part of any country. That which produces disease in the highlands, does not in the low and wet grounds; one constitution is epidemical in cool countries, another in warm; and in consequence of peculiarity of situation, that which is epidemical in one hot country, is not in another. Thus, in Senegal a wet season is sickly; in the West Indies a dry one: because the first is an open extensive country; the latter, for the most part, small islands with deep marshes near the principal towns; whence, moisture abounding, a wet constitution of the atmosphere is not epidemical; but a dry one is. No instance can be produced

of an epidemic in the north of Europe, or of America, which was not preceded by a hot summer ; or of a general epidemic in the West Indies, not preceded by a dry one ; or of one in the middle and south-western states of America, without much rain.

1158. With regard to the irregular periods at which epidemics return, they correspond precisely with the periods at which heat and moisture concur in operating on vegetable matter ; and the time of their continuance is precisely the time of the continuance of such concurrence ; and their disappearance depends on its cessation.

1159. Thus, when they concur, an epidemic appears, and continues until the heat fails on the coming of winter, as generally happens in temperate climates ; or until the moisture is entirely evaporated in the midst of summer, as sometimes occurs in this country, and every year in Egypt and Syria, and in Senegal ; or until abundance of rain covers the vegetable matter from the action of heat, as sometimes occurs in wet seasons in low countries ; and is sometimes the effect of design to put an end to an epidemic.

1160. The language of physicians on this subject implies that an epidemical constitution continues sometimes for several years, and is independent of the changes of weather. This, however, is entirely destitute of a foundation in truth. Several instances have been given of the most abrupt changes from health to sickness, not only in different years in continuity, but in the same year.

1161. Thus, in the neighbourhood of Portland, in Maine, the summers of 1797 and 1798 were hot and

wet, and sickly ; that of 1799 rainy and cool, and healthy ; that of 1800 hot and dry, and sickly (there are marshes in the neighbourhood) ; and that of 1801 cool and rainy, and healthy until the last of August ; and dry and sultry, and sickly in September (213. 214). Here the epidemical constitution continues two years, disappears in the third, returns in the fourth, and does not appear again until late in the fifth ; and all these changes perfectly correspond with the changes in the sensible qualities of the atmosphere (1126).

1162. The most abrupt changes from sickness to health, and from health to sickness, occurred also in the following instances, the epidemic always appearing with the concurrence of heat and moisture, and disappearing on the failure of such concurrence.

In Ohio, 1822 was very dry and healthy, and 1823 very wet and sickly (244. 245) ; in Kentucky, 1819 and 1820 very dry and very healthy, 1821 and 1822 very wet and very sickly (248 to 250) ; in Natchez, 1816 very dry and healthy, 1817 wet and sickly, 1818 dry and healthy, 1819 remarkably wet and sickly (254), 1823 very wet and sickly (255), 1825 wet and sickly (265) ; in New-Orleans, 1817 wet and sickly, 1819 much wetter and more sickly (309. 310) ; in the valley extending along the western side of the Blue Ridge, through Virginia, Maryland, and Pennsylvania, 1822 excessively dry and very healthy, 1823 excessively wet and very sickly (361. 362), 1824 wet and sickly in July, dry and healthy afterwards (368), 1825 dry and healthy (369), 1826 dry and generally healthy (370) ; and lastly, in Philadelphia there were remarkable changes from sickness to health, and from health

to sickness, from 1793 to 1817, in all of which the presence or absence of the epidemic constitution manifestly depended on a certain temperature (404, &c.).

1163. The influence of local causes is strongly marked in the cases stated in the following passages, viz. 149. 151. 156. 158. 163. 216. 218. 219. 224. 226. 229. 232 to 239. 244. 253, &c. 311. 317. 340. 364. 365. 366. 373 to 380. 383. 386. 393. 400, &c.

1164. Stronger evidence cannot be desired, that that constitution or state of the atmosphere which produces epidemics, is not "independent of all local and perceptible causes, a certain degree of temperature alone excepted" (1126); and that it has not occurred "at irregular periods, continued an indefinite length of time, and at last disappeared, without disclosing any vestige of the cause of either its rise, or its decline" (1127).

1165. The truth of the doctrine, that the presence of miasmata constitutes the epidemic constitution, is set in a strong and clear light by the fact, that the cases in which local causes are efficient in the production of epidemics, confirm the general principle, moisture in these cases being supplied by the nature of the place in which the epidemic appears.

## CHAPTER XVI.

### SOME GENERAL REMARKS ON THE ORIGIN OF EPIDEMICS.

1166. We shall now make some general observations on the origin of epidemics, which could not well be introduced before without interrupting the course of the argument.

1167. These diseases have been attributed, we have seen, to an unknown epidemic constitution of the atmosphere, or such a state of the atmosphere as produces epidemics, to contagion, and to miasmata, or the joint operation of miasmata and cold.

1168. The assertion of the dependance of epidemics on an unknown epidemic constitution of the atmosphere, is a mere acknowledgement of ignorance of the real cause, contains no doctrine, and proposes no cause for the effects observed.

1169. The only agents proposed as the causes of these effects, are contagion and miasmata, the latter alone, or in combination with cold.

1170. The doctrine that contagion is the remote cause of epidemics, rests on the single circumstance of the disease appearing after communication with the sick. Not to repeat, that if propagated by contagion they would never stop until all were affected (710), nor that they want the characteristics of a contagious disease (718, &c.); nor that they often com-



mence without communication with the sick (732, &c. 786, &c. 819, &c.), and often do not appear after communication with the sick (747, &c. 767, &c. 806, &c.); suffice it to say, that this argument would prove that intermittents are propagated by contagion.

1171. Thus, in Brucetown, in Frederick county, in Virginia, in the autumn of 1823, almost every individual in the town had an attack of the intermittent or remittent bilious fever, and several died. A relation of one of those who lay sick a considerable time and at length died, hearing of his illness, rode eighty miles to his assistance. He attended him night and day for a week or ten days. He at length returned home, when the season was quite healthy, and soon after, within a few days, had a violent attack of bilious fever. As the servants were also sick, a white girl was hired. She arrived there perfectly well, and in two days was taken sick. She had a violent ague, which returned on the third day, and on the fourth she insisted on being carried away. A woman and all her family were sick. Four female relations in succession went, from a distance, to nurse the family. One after the other, they were taken sick and carried off. A gentleman had a severe attack. A sister came to his assistance. He recovered. She went home, sickened and died.

It is evident from this, that there is the same reason for believing that our common intermittents and remittents are contagious, as for believing it of any epidemic disease.

1172. This opinion indeed was entertained by physicians before the dependance of intermittents on miasmata was so fully established as it now is. Cleg-

horn says, "These tertian fevers have as good a right to be called contagious, as the measles, small-pox, or any other disease ; for although, in that season, there certainly is a peculiar disposition in the air to affect numbers in the same way, yet those who are much conversant among the sick are most liable to catch the distemper."<sup>1</sup>

1173. It is evident, therefore, that intermittents in this respect stand upon the same ground with other epidemic diseases ; and that that which is considered as the effect of contagion, viz. the spreading of the disease, is no evidence of any thing more than the general operation of the cause, whatever that may be.

1174. There are some cases, however, so strongly urged as evidence incontrovertible of the contagious nature of certain diseases, that it may be proper to notice them in passing.

1175. Russel mentions the following occurrence as evidence of the contagious nature of the plague. "In the plague of Moscow in 1771, the populace, who had been prohibited from paying the accustomed last duties to the dying and the dead, rose tumultuously in a religious phrenzy, and broke into the hospital, and other places where the infected were lodged ; restored the religious ceremonies about the sick ; kissed their departing friends ; and would not permit the bodies to be buried, as before, without the city. The insurrection was quelled in a few days, but *much mischief was produced* by this concourse of a distracted people. 'Tot hominum sanorum, ægrotorumque concursu, contagio aucto, mille et ducenti ultraque singulis diebus

<sup>1</sup> Cleghorn on the Diseases of Minorca, p. 121, note.

moriebantur.”<sup>1</sup> The insurrection happened the fifteenth of September, in the first part of which month the mortality from seven hundred daily, rose *gradually* to one thousand. Merten’s Observ. p. 84, Vindibon. 1778.”<sup>2</sup>

1176. There was, however, no greater increase of the number of deaths in this case than is common in epidemic fevers at that time of the year, in every country in which they appear. September is precisely that month in which, in most temperate climates, epidemic diseases *gradually* arrive at their greatest height, after which they gradually decline on the approach of winter; as this plague at Moscow no doubt did, inasmuch as this disease uniformly declines at that time of the year in countries of moderate temperature (854). Sydenham, speaking of the plague in 1665 in London, its great height in August, and great decline in November, says it seldom appears at any other season of the year.<sup>3</sup>

1177. The disease which caused the death of a number of persons in London, at the sessions at the Old Bailey in May 1750, has been very confidently attributed to contagion; but the occurrences were utterly inconsistent with the production of the disease by such a cause. Even the variolous contagion, it is well ascertained, affects only those who are very near to the sick; but the persons who suffered on this occasion were far beyond the reach of any known contagion, viz. about twenty-five feet from the persons who were supposed to have carried the contagion into

<sup>1</sup> By the concourse of so many men in health with the sick, the contagion being increased, more than twelve hundred died every day.

<sup>2</sup> Russel on the Plague, p. 250, note. <sup>3</sup> Sydenham’s Works, p. 77.

court. Moreover, most of the persons who were attacked were at the farthest end of the court-room, while those immediately around the prisoners are not represented as having been affected. Lastly, the singular circumstance of almost every one who was attacked being on the left side of the room, and in elevated seats, points to some other cause than one which, if it exist, must extend alike to all around. It is plain enough, therefore, that the cause of this disease could not have been contagion ; what it was, is as plain from the statement of Bancroft.<sup>1</sup>

1178. The court was excessively crowded to hear the trial of a captain in the navy for killing another in a duel. The trial was very long, and the house was so close that the air became in a short time exceedingly offensive ; and although the weather was cold, a cold piercing east wind then blowing, the room was very warm. A window was therefore opened on the left side of the house, and a current of cold air forcibly rushed in, and, the window being much higher than the heads of the people on the floor, passed over them to those who were more elevated, and therefore exposed to its action. Hence the number affected on the left side of the house. Such exposure to cold air, when the person is much heated, has often produced violent fever.

1179. Another case represented as evincing incontrovertibly the propagation of fever by contagion, is that of the Hussar frigate. Blane calls it an *experimentum crucis*. He says, "There are well attested examples of its being communicated from one ship to

<sup>1</sup> Bancroft on Fevers, p. 443.

another in the middle of the ocean. As exhalations of the soil are here out of the question, any one such fact may be considered as an *experimentum crucis*, incontestably establishing the principle, and upon this alone the whole merits of the case might be rested."<sup>1</sup> He then refers in a note to three cases, of which that of the Hussar is one.

1180. This language implies that similar instances of the communication of fever had frequently occurred on land, but that the force of the inference from them had been evaded under the pretence that miasmata had produced the effect; that here however none could be supposed to exist, and therefore that the occurrence of the disease on board this ship is an *experimentum crucis*. Both these positions are true if this case be such a test; that it has frequently happened on land, that patients in yellow fever, carried into companies of people at a distance from the place where the fever prevailed, communicated it to them; and secondly, that the miasmata alleged to be the cause of the fever in such cases, could not have existed on board the Hussar. But they are both untrue. First, it is well known that thousands of instances have occurred of yellow fever having been carried into villages adjoining cities where that disease prevailed, without communicating it to an individual. This is so notorious in this country, that it would be a waste of time to quote cases to show it. Secondly, so far from its being certain that the Hussar could not have had miasmata in her hold, such was the foul state of the English ships at that period, that the contrary is almost certain.

<sup>1</sup> Blane's Medical Logic, p. 258.



1181. Admitting the facts as stated in this case to be true, that after taking a French ship, the yellow fever prevailed on board the Hussar, the occurrence is not of such a decisive character as Blane represents it to be; it is not an *experimentum crucis*. To make it such an experiment, incontestably establishing the doctrine, the absence of every other cause must be certain. Blane shows he was fully aware of this, when he says the occurrence took place in the middle of the ocean, where exhalations<sup>1</sup> of the soil are out of the question. It is however well known that this disease has often appeared on board of ships at sea, which have not had communication with any other ship, or any place where the yellow fever prevailed; as in the case of the Busbridge on her voyage from England to the East Indies (740), or of the General Greene on her voyage from Newport, Rhode-Island, to Havana (739). Blane himself asserts that this fever originates on board of ships on long voyages.<sup>1</sup> To make this case such a test, it ought to have been shown that the circumstances, which give rise to this fever on board of ships at sea, did not exist on board the Hussar. This has not been done, and therefore this is not an *experimentum crucis*.

1182. There are moreover some circumstances connected with this transaction that completely destroy its claim to be such a test. There were two English vessels in company, the Hussar and the Thetis, which captured two French vessels, the Raison and the Prevoyante. The Hussar took the Raison, but received on board none of the crew that were sick. The The-

<sup>1</sup> Blane's Medical Logic, p. 248.

tis took the other ship. The latter was more sickly than the *Raison*, both on the voyage and after their arrival at Halifax; but the *Thetis* escaped the fever entirely.<sup>1</sup>

1183. The case of the *Regalia* has a much better claim to be considered in that light. It is asserted by Blane that the fever originates on board of ships at sea, but he also contends that it is propagated by contagion. The first is admitted; the second denied. To put the question to the test, a yellow fever patient is carried from one ship to another, say the *Hussar*; the disease soon after spreads on board that vessel. But inasmuch as both ships are in the same climate, and the disease, if it appear in both, must of course make its appearance in one of them first, and as the circumstances admitted on all sides to be capable of originating the fever may have existed in both, a question arises whether they have been excluded or not. Nothing certain being known on that subject, and it being certain from the known state of ships in general (168, &c.), and from the climate in which the fever appeared, that those circumstances may have existed, the experiment cannot be deemed conclusive, and we must resort to a new one.

1184. Such an one was made on board the *Regalia*, in circumstances entitling it to be considered as completely an *experimentum crucis*, as any experiment of the kind can be. She had suffered most severely for a long time; her crew was perpetually sick, and dying in such numbers as to require continual recruiting, and while traversing the West India seas in every di-

<sup>1</sup> Bancroft on Fevers, p. 496. 497.

rection, she was leaving sick persons at every port (171, &c. 751). Her hold was at length cleaned out perfectly, and thoroughly dried by means of stoves heated very hot, the hatchways being closed. After having been thus thoroughly cleaned out, she sailed with a crowd of prisoners from the jails of Guadaloupe, and with a patient on board dying of yellow fever the day before she left Basseterre roads, but no fever was communicated to any of the passengers (174).

In this case the circumstances in which the fever originates were entirely removed by the thorough cleansing of the vessel. The contagion, if it exist, was then introduced, but no effect followed, therefore no cause was there present, and contagion does not exist.

1185. Considerable stress has been laid on the prevalence of the plague in Malta, in 1820, and it has been urged very strongly as establishing the doctrine of the contagious nature of that disease, inasmuch as that island is almost a bare rock, without rivers or morasses.

1186. The evidence on which rests the belief that the plague was introduced and propagated by contagion, is as follows. A vessel arrived from Egypt with the plague on board on the 28th of March. She was received into quarantine, and the crew were taken to the Lazaretto, situated in a small island in the middle of the harbour, where the captain and his servant sickened in a day or two after being received, and died with symptoms of the plague. On the sixteenth of April the first case appeared in one of the principal streets of Valetta; the person affected was the daugh-

ter of a shoemaker. From that time till the 17th of May eight persons are mentioned as having been affected, and all died but one; and all belonging to the house or very intimate with the family, and often with them during their sickness. After that time it spread widely.

1187. I have not seen the work of Dr. Faulkner, but the reviewer says, "The first position, or the introduction of the contagion from the vessel to the shore, our author fails to prove by *direct* evidence. The current report at Malta was, that one Salvator Borg, a shoemaker, having purchased a piece of linen on board the San Nicholo, introduced the fomites into his own family, whence it radiated afterward to other persons. Dr. Granville has since stated that this was authenticated as a fact, under the authority of Sir Thomas Maitland's despatches, and other official papers."<sup>1</sup>

1188. There is no evidence here that can be relied on to prove any thing: a current report, or a despatch of a government officer founded on it, is not evidence. If there had been any attainable, Dr. Faulkner, considering his object in writing, and the opportunity he had for the investigation, would have discovered it.

1189. Admitting, however, the statement as true, the contagion, if it exist, must have been introduced by the man himself, or by the linen. He himself is not stated to have been attacked until eighteen days after his daughter; it could not therefore have been introduced by contagion proceeding from himself (700); and therefore, if at all, must have been introduced by the linen.

<sup>1</sup> Medico-Chirurgical Review, Vol. 1, p. 590.

1190. When, however, we consider the facts stated respecting the unreserved distribution of the clothes of the dead, immediately on the cessation of the plague in Egypt, and that they are worn by thousands with perfect safety, it is impossible seriously to believe that this piece of linen could have been the means of producing the mischief (783). It is most evident, that if the plague could thus easily be introduced into a town, the European cities of the Mediterranean coast and islands would be perpetually harassed by that disease, inasmuch as they continually trade to the Levant, and the common practice of smuggling must annually introduce into them many articles in the same way with the linen abovementioned.

1191. As to the occurrences after the sixteenth of April, there is nothing more in them than what is seen every year in the prevalence of the autumnal diseases. They must commence somewhere; they do so at some point where the cause is at the time most efficient, and of course all that are near and all that approach are liable to be attacked.

1192. There is one circumstance rested on with considerable confidence, but with little propriety.

The Augustine convent was situated in a remarkably healthy, spacious, airy part of the town, and the inhabitants had, from the very beginning, observed the greatest caution in shunning communication with the public. "It was at length, however, infected, in consequence of one of the servants, who was caterer by occupation, having, in disobedience of public orders, gone into a very contaminated part of the town, called the Manderaggio, and purchased infected



clothes. Shortly after his return he made full confession of the circumstance, when one of the brotherhood belonging to this convent, out of compassion, immediately volunteered to attend him, placing himself, at the same time, in strict quarantine with the patient. Both nurse and patient immediately fell victims to the disease, but *no other individual under the same roof was ever assailed.*"<sup>1</sup>

1193. This case certainly affords but equivocal support to the doctrine of contagion. The inhabitants of a large house "in a peculiarly healthful, spacious, and airy part of the town," avoid all communication, from the very beginning, with the public, and of course more particularly with the sickly part of the town; the language seems to intimate that they were *shut up* (771); one only went into a very sickly part of the city, and purchased *infected clothes*, and *shortly after returning* confessed what he had done. Another of the inhabitants, together with the one who had exposed himself to the cause of the disease in one of the most sickly parts, *went into strict quarantine*, (where is not said,) and both died.

All who continue in the spacious airy house escape, notwithstanding that the contagion is alleged to have been carried in; one who exposed himself in the town, and another, *who went into strict confinement with him*, only died.

1194. It is certain therefore that the evidence offered here in support of the doctrine of contagion is entirely insufficient. Indeed the work itself affords positive evidence to the contrary. On the subject of

<sup>1</sup> Medico-Chirurgical Review, Vol. 1, p. 591.

frictions with oil, Dr. Faulkner says, “There were *so many* instances of persons living in the closest intercourse with the infected, *who escaped without the use of oil*, and *so few well attested cases of persons having come into actual contact with pestiferous matter* who were protected by oil alone, that I cannot hesitate to conclude, that the opinion of its possessing any independent or certain prophylactic efficacy, is destitute of foundation.”<sup>1</sup>

This single sentence contains evidence, that in very many instances persons living in the closest intercourse with the sick escaped; and that in *some* well attested cases, persons who had even been in actual contact with pestiferous matter, escaped; the latter using friction with oil as a preventive, on which, however, Dr. Faulkner’s experience led him to place no reliance.

1195. Let us now examine into the situation of this island, and the state of the weather in which the disease arose and declined.

The island of Malta is a freestone rock, which has been quarried in order to build houses, immense fortifications, &c. until the face of the island, “when viewed in perspective, resembles an extensive stone-cutter’s yard.”<sup>2</sup> A great part of the island is a barren waste, but the soil of the inhabited part is rich, though very shallow; seldom above a foot in depth. There are three spots on the habitable part which may be termed marshy or moist.<sup>2</sup> There are no rivers, but some excellent springs, and an aqueduct leading to Valetta.<sup>3</sup>

<sup>1</sup> Medico-Chirurgical Review, Vol. 1, p. 594.

<sup>2</sup> Ibid. p. 587.

<sup>3</sup> Rees’s Cyclopaedia.

In the spring rain falls in considerable quantity, sometimes in torrents. In summer the thermometer ranges from 75 to 85 degrees in the shade.

1196. It is evident from this account that there are some marshy places; that the holes in the rock made by quarrying must, in wet years, form numerous small ponds, as in such a broken rocky piece of ground I have seen. It is certain that in a wet year, such a surface must produce miasmata in abundance; and, considering the shallowness of the soil, not more than a foot to the rock, that a hot summer must soon exhaust the moisture, stop the production of miasmata, and consequently put an end to the disease produced by them. Accordingly we find that the plague on this occasion broke out in April and May,<sup>1</sup> spread very rapidly, and was decidedly checked by the seventeenth of July.<sup>2</sup> This state of things is much the same with what occurred in Aleppo in Syria: there also there were heavy rains early in the spring, and great heat and drought in the summer; and in very wet springs the plague appeared, spread rapidly, and declined in July and August (885. 886).

1197. It is manifest, therefore, that the evidence offered by Dr. Faulkner is not sufficient to show that the plague is propagated by contagion; indeed that there is nothing new in it, nothing but what has been often brought forward, viz. the occurrence of the disease in some after having communicated with the sick, at the same time that it is alleged, in the very same work, that numbers who communicated with the sick, and some who were in actual contact with the pesti-

<sup>1</sup> Medico-Chirurgical Review, Vol. 1, p. 590.

<sup>2</sup> Ibid. p. 593.

ferous matter, entirely escaped. It is moreover evident, that it derives all the force it has from the supposed absence of the circumstances favouring the production of miasmata, this being rested on as strong ground in support of the doctrine. But there is nothing in the circumstances inconsistent with the dependance of the disease on miasmata; and the time of the rise and the decline, viewed in connexion with the nature of the surface, the spring rains, and the summer heat, correspond so entirely with the occurrences in similar circumstances in Aleppo, as clearly to point to miasmata as the cause.

1198. If this is the case when this epidemic is considered almost without reference to any other, how much stronger is the argument, when we take into view the circumstances in which the plague has appeared, prevailed, and declined in other countries. We have seen that on the continent of Europe, in England, in Egypt, and in Aleppo, the concurrence of heat and moisture is necessary to the existence of the plague (854. 864. 865. 887). The conclusion stands on such strong ground, that nothing less than *a case clearly made out*, of the prevalence of the disease in the absence of such concurrence, can shake it. In this instance at Malta, this is so far from being done, that there is a certainty that in every year miasmata are produced, and that in a very wet year they must abound until the country is dried up by the heat of summer: moreover, the disease prevailed precisely at that period of the year when they were most likely to have been abundant, and ceased precisely at that time, when, from the shallowness of the soil and the heat of the climate, the production of them must have ceased.

1199. It is evident, therefore, that of the cases alleged as *experimenta crucis* of the truth of the doctrine of the contagious nature of epidemic diseases, none afford ground of conviction of the truth of that doctrine.

1200. Finally, when we consider that in temperate regions, all these epidemics arise in hot weather and decline in cold weather (142); in *wet* countries appearing in *hot, dry* weather, and not appearing in *cool, wet* weather (505. 507. 524. 538); and in *dry* countries appearing in *hot, wet* weather (245. 249. 250. 362), and not appearing in *dry* weather (244. 248. 361); that in *hot, dry* countries, they appear in *wet* seasons, and *cease* when the country becomes *dry* (484); that in *hot, wet* countries, they *arise in dry* seasons, and *cease in wet*; in *very marshy* countries the *hottest* and *dryest* seasons being the most sickly (437. 441. 525); and that when *entirely* dried up they become *healthy* (330. 865. 887); it is evident that *the concurrence of heat and moisture is the sine qua non*, the indispensable condition of their appearance: and when we further consider, that in these circumstances a vast quantity of gas is continually produced, and that the effects observed, viz. the morbid symptoms, appear in those who are in the direction of the wind blowing over these sources of miasmata, and not in those who are not in that direction (163), it is evident that the cause is a vapour or gas arising in those circumstances; and the perfect emptiness of the pretensions of contagion to be the cause is shown by the fact, that the effects are seen wherever that cause, miasmata, is produced, and wherever it is carried, and no where else.



## CHAPTER XVII.

REMOTE CAUSES ARE PREDISPOSING OR EXCITING.

SOME ADDITIONAL REMOTE CAUSES.

1201. The remote causes of fever have been distinguished into predisposing and exciting causes. The same cause is however sometimes predisposing, sometimes exciting, and sometimes both. The distinction therefore does not relate to the nature of the cause, but to the order of the operation.

1202. The predisposing are those whose operation disposes to disease, that is, gradually leads to or produces disease. The exciting are those which immediately cause it. But as the latter, if first in action, may not have immediately excited, but would have led along to disease; and the former, if in action after the other, would have immediately produced it; and further, either would, if the other had not acted at all, have finally produced disease, it is evident that the exciting causes only fill the measure of internal derangement, which produces the symptoms in question.

1203. The remote causes may also be divided into those which operate upon great numbers, and those which may operate on individuals only. The former produce epidemic disease, such as miasmata, cold, and in some instances hunger or famine. The latter pro-

duce single cases, which are called sporadic cases; such are fatigue, intemperance, &c.

1204. We have now seen that all the known remote causes of fever weaken the action of the heart, and that weakened action of the heart precedes every fever (691). Weakened action of the heart is therefore one link of the chain of causes extending from the remote causes to the symptoms of fever (18); and all those causes which produce this link of the chain, are themselves remote causes of fever; inasmuch as all those causes which produce it, are remote causes of its effects (17).

1205. Excessive venery, therefore, which remarkably weakens the action of the heart, is a remote cause of fever; it has indeed been enumerated by many authors as a very active cause of fever during great pestilence.

1206. Excessive evacuations also weaken the action of the heart and are remote causes of fever; and they also have been enumerated as such by authors.

1207. Abstraction of accustomed stimuli weakens the action of the heart, and is a remote cause of fever. Tobacco is a stimulus to the use of which some are so much accustomed, that the privation leaves them very languid; and Trotter mentions this privation as predisposing sailors to an attack of typhus fever.<sup>1</sup>

1208. The excessive action of the heart and arteries in fever, may be mentioned among the causes of weakened action of the heart. Excessive action however induced, soon terminates in weakened action, proportioned to the previous excitement. It seldom

<sup>1</sup> Trotter, *Medicina Nautica*, Vol. 1, p. 202.

happens that a fever lasts longer than twelve hours without the action of the heart moderating.<sup>1</sup> Sometimes, but rarely, it continues with great violence for several days with little remission; but when it does finally sink, it is into a very low and dangerous state of feebleness.

We next proceed to inquire into the effects of weakened action of the heart.

<sup>1</sup> Cleghorn's Observations on the Diseases of Minorca, p. 140.

END OF VOLUME 1.

*W. Graham*



